The pages which are missing were removed because they were advertisements.

INDEX TO AERIAL AGE

VOLUME XIII

A

PAGE

Accidents:

- Ambulance plane fall due to weather... 471
- Bromwell, Miss Laura, killed while looping... 317
- Caproni wrecked by gale... 78
- Clark, Lt. Willard S., killed on June 19 547
- Curtiss Eagle Ambulance Disaster, The Press on the... 291
- Douglas, The late Capt. Howard T..... 412
- Hawker, The late Harry G... 460
- Jacuzzi seven passenger monoplane wrecked... 461
- Lawson airliner in accident... 222
- Rolfe, The late Monte, killed in aeroplane accident at Havana... 608
- ZR-2 disaster, The...607, 611

Advertising:

- "Aerial Advertising from Maine to Florida," By Harry D. Copland, with photo... 7

Aerial Mail:

- Acceleration of Morocco Service... 572
- Aerial Mail Service, The...364, 586
- Aerial Mail in China... 173
- Aerial mail investigation... 316
- Aerial mail service in Australia... 448
- Advertising German air mail services... 596
- Air mail to Morocco... 112
- Air postal stamps for China... 548
- Airships and British empire mails... 448
- Aleppo-Alexandretta air service... 232
- Bayonne-Bilbao-Santander air service... 232
- Berlin-Moscow air mail... 232
- British air mail... 622
- Dutch Air Post charges... 280
- Ecuador-Colombia air mail...160, 424
- French air mail lines... 448
- German air mail safety service... 498
- German air mails... 548
- Mail service for Newfoundland... 88
- Mail service between Bahamas and Florida... 448
- Mexico-Texas air mail... 222
- New German air mail lines... 498
- Proposed new mail service to Antipodes 184
- Proposed air service between Montevideo and Buenos Aires... 448
- Shaughnessy, Col., appointed second assistant postmaster general... 154
- Stuttgart-Constance air mail service... 548
- U. S. Post Office Dept. Chart 53, 149, 221, 341, 389, 562
- Washington-New York air mail discontinued... 292
- West Australian air mail... 448

Aero Club of America:

- Aero Club Field House officially opened on May 15... 244
- Club House at Hazelhurst... 52
- Dinner to Gordon Bennett pilots... 608
- National campaign for membership for the support of aeronautics... 512

Aero Clubs:

- Aero Club of Alsace-Lorraine founded at Strasburg... 160
- Aero Club of Columbus third annual banquet and dance... 398
- Aero Club of France elects president and officers... 232
- Aero Club of Holland interested in aerial touring... 88
- Aero Club of Ithaca elects officers... 197
- Aero Club of Massachusetts now has headquarters at 16 Somerset St... 135
- Aero Club of Red Oak, Iowa, to stage aerial carnival... 293
- "Aeroplanette" club suggested...525
- Aero Miles City Club recently incorporated... 28
- Associated Aviation Clubs... 28
- Aviation Country Club of Detroit... 223
- Brussels Aero Club spring meeting... 448
- Cleveland Aviation Club active... 340
- Dayton Club hears first lecture... 28
- Hartford Aero Club... 412
- Las Vegas Aviation Club forming... 173
- Royal Aero Club of Great Britain... 147

Aero Club of Pennsylvania

- In new quarters... 148
- Monthly news notes...492, 620
- Spence, D. J., Jr., and A. Stanley Truscott added to Board of Directors... 561

Aero Club of Southern California:

- Club news... 29
- In new quarters... 196
- To hold aviation meet on July 16 and 17. 221

Aerodromes:

- Aerodrome established in Rotterdam... 256
- French Customs aerodromes... 498
- Great Britain's eastern aerodromes... 64
- Largest aerodrome in Holland recently established at Rotterdam... 498
- Prague aerodrome statistics for 1920... 548

Aerodynamics:

- "Aerodynamics at Very High Speed," By Lt. Col. A. Guidoni... 31
- Experimental aerodynamic data... 374
- "Influence of Span and Load per Square Meter on the Air Forces of the Supporting Surface," By A. Betz... 224
- "Standardization and Aerodynamics," By Wm. Knight... 343

Aerofoils:

- Absolute Coefficients and the Graphical Representation of Aerofoil Characteristics 441
- Aerofoil development... 123
- "Extract from a Report of the Resistance of Spheres of Small Diameter in an Airstream of High Velocity," By Capt. Toussant and Lt. Hayer... 199
- Properties of aerofoil sections... 246
- "The Resistance of Aerofoils," By W. F. Gerhardt...152, 175
- "The Variation of Aerofoil Lift and Drag Coefficients with Changes in Size and Speed," By Walter S. Diehl.. 518

Aeromarine Company:

- Aeromarine Airways, Inc., carries 2007 passengers in three months... 586
- Seeing New York in Aeromarine sightseeing busses... 317
- Statistics of the company... 413
- Washington to New York with ten on board... 220

Aeronitis: pp. 18, 42, 66, 90, 114, 138, 162, 186, 210, 234, 258, 282, 306, 330, 354, 378, 402, 426, 449, 474, 500, 526, 550, 574, 598, 624.

Aeroplanes:

- Aerial Ambulance... 40
- Aeroplanes and the fight... 413
- British battle planes carry scout machines 413
- Early aeroplanes... 499
- Experimentation with low-powered sport planes... 549
- First plane in flight, The... 219
- Flying machine on the Albert Wick principle... 112
- German all-metal commercial machines.. 302
- "Loads and Calculations of Army Aeroplanes," By Ing. Stelmachowski... 9
- New naval seaplane... 413
- Unusual Italian monoplane invented by Epaminonda Bertucci of Rome... 498
- Vickers Vimy aeroplane ambulance (with 2 photos)... 131

Aeroplanes, Types:

- Aeromobile exhibited at Atlanta section of the Assn. of Civil Engineers... 222
- Albatross, description of Albatross W-10 flying boat... 182

Amphibians:

- New Supermarine amphibian, A...414, 424
- Report of a lecture on... 302
- Avia, Desc. of B. H. Monoplane... 374

Baco:

- Skylark, Description of... 226

Barnhart:

- Bastianelli, Brief desc. PRBI flying boat 446
- Bellanger Works build monoplane... 232
- Berkel, Brief desc. The Berkel naval monoplane... 254

Breda:

- Brief. desc. New Italian tourist aeroplane 422
- Characteristics of aeroplane entered in Mapelli cup... 230
- Breguet Leviathan, The... 62

Bristol:

- Bristol "Tranp," The... 86
- Commercial ten-seater biplane, Illus. desc. of... 487

Caproni:

- Caproni to build new triplane... 222
- Giant Caproni tandem triplane flying boat "Sesta Calende," Photo... 76
- Giant Caproni tandem triplane... 103
- Caudron, Short desc. of C43 multimotor biplane... 206
- Continental, Giant aeroplane under construction... 54

Curtiss:

- Achievement for Curtiss OX... 586
- Long mileage of Curtiss planes... 414

Curtiss Eagle:

- Ambulance used by Army Air Service at Mitchel Field, Photo of... 100
- Ambulance plane fall found due to weather... 471

PAGE

- Curtiss JN4D-2 model built by James Mitchell... 185
- Curtiss Seagull, A flying boat's work in Australia... 524
- D. F. W., Brief desc. of three passenger limousine... 422

Davis-Douglas:

- Cloudster and Kinner Airster—Photo.. 148
- Cloudster completed and has preliminary trials... 198
- Cloudster to attempt trans-continental flight... 316
- Recent flights of the Cloudster... 462

DeHavilland:

- D. H. 14 Bomber—Desc... 158
- D. H. 14 Day Bomber—Desc... 182
- D. H. Limousine, The—Desc... 230
- DeHavilland monoplane practically ready to fly, The... 548
- D. H. Cantilever monoplane, The... 86

Dornier:

- Dornier machines... 134
- Twin-engined monoplane, type G. 1, Desc. 422
- Elias TA-1 tested... 351
- Fairey "Titania", The... 110
- Fairey Co. have plans for building giant trans-Atlantic flying ships... 622
- New Fairey flying boat to be launched in May (Brief desc)... 182

Farman:

- Goliath reported to have passed elimination trials for the French "Concours Militaire"... 208
- Goliath wins French Grand Prize... 364
- Fiat, Brief desc. The Fiat 3-seater 300 H. P. aeroplane A, 1... 422

Fokker:

- Desc. Fokker commercial express biplane type C11... 151
- Fokker C11 commercial three-seater, 185 H. P., B. M. W. motor—Photo... 151
- F 111 six-seater monoplane, ilus. desc.. 271
- Fokker commercial limousine, Latest type of—Photo... 485
- New Fokker built for instructional work. 548

Friesley:

- Friesley Falcon, The—Desc... 225
- Handley Page, The new H. P. Monoplane... 304

Hawa:

- Hawa Commercial Triplanes, The, By Benno R. Dierfeld... 34
- Huff-Daland, Description... 150
- Huntington monoplane, built in Nebraska by John Afflerbaugh... 449

Jacuzzi:

- Seven passenger monoplane flight tested 198

Junker:

- Junker all-metal monoplane changes... 53
- Performance test of Junker SL-*6, with 185 H. P., B. M. W. engine... 35
- L. F. G.-V3a flying boat—brief desc... 522
- Latham flying boat—brief desc... 570
- Liore & Olivier, details of six-seater commercial seaplane... 62

Loening:

- Hydro-monoplane breaks altitude record Aug. 16... 584
- Monoplane flying boat establishing an altitude record of 19,500 ft.—Photo Cover Sept. 5
- Monoplane flying boat which established altitude record of 19,500 ft. illus. desc. 613
- P. W.-2 tested... 351

Martin, Glenn L.

- Martin planes in bombing tests, The...317
- Morane-Saulnier, A new monoplane—short desc... 160

Mummert:

- Mummert sportplane, Desc... 449
- N. E. V. O. five-seater commercial plane 52

Orenco:

- Type D fighter, Flying model of the..17, 41

Potez:

- Potez aeroplanes, The—Details of 3 types... 206
- Henry Potez aeroplanes, The new... 570

Remington-Burnelli:

- R. B. 1, Description of the... 420

Ricci:

- Characteristics of aeroplane entered in Mapelli cup... 230
- S. E. 5, Bruce A. Mapes builds scale model of... 161
- S. I. A. I., New Italian seaplane... 278

S. V. A.:

- Ansaldo 300-C Limousine, The... 275

PAGE

Sablatnig:
Sablatnig sporting monoplane, The, Short desc. 182
Brief desc. of the Sabi P. 3 254
Savoia, Brief desc. of Savoia hydroplanes 8
Short Silver Streak, first British all-metal machine, bought by Air Ministry 40
Siemons-Schuckert, New 24 passenger machine 40

Spad-Herbemont:
The Spad-Herbemont aeroplanes 206
Illus. desc. "Berline" S. 33 488, 489
Staaken 1000 H. P. monoplane 134
Supermarine, A new amphibian 414, 424

Van Berkels:
Van Berkel W. B. seaplane, Desc. 230
Van Berkel seaplane (monoplane), Desc. 302
Van Berkel activities 328

Vickers:
Vickers Vimy aeroplane ambulance 131
Vickers Red Cross machine 86

Waterman:
Racing monoplane with OXR Curtiss motor—photo 436
Westland six-seater, Desc. of the 350
Wibault aeroplane, General characteristics 8

Zeppelin-Dornier:
Do-C-3, Desc. of 278
Zeppelin-Staaken all-metal monoplanes, The 182

Air Service:
Aircraft with the fleets 15
Airship "Roma" arrives at Norfolk 571
Co-ordination of Army and Navy practices in regard to experimental contracts for aircraft 56
Airliner Engineering Co. incorporated at Long Island 125

Airports:
Airport urged for Newport 364
Canadian border air harbors 414
Constantinople airport 232
Danish mission to England to study aerodrome organization, A 184
Gottenborg air station, The 280
Japan establishes flying harbor 328
Thames as London's airport, The...16, 328
Tokyo civil airport 596

Airship:
Airship Piloting—Paper by Maj. G. H. Scott 158
Boerner, A, Dutchman, designs airship 208
British terms for disposal of airships 376
Efficiency of non-rigid Naval airship 87
"The Employment of Airships for the Transport of Passengers," By Umberto Nobile. 618
Italian airship "Roma" handed over to American Air Service 4
Possibilities of Airship Services, The, By Lord Montagu of Beaulieu 393
Rigid Airships—Paper by A. J. R. Campbell 134
Schutte-Lanz rigid airship construction. 470
Vickers-built airship for Japan, New 352
Zodiac Sport-Airship, Short desc. 182

Airways:
How to establish an airway 276
National airways centre in New York 484
System of airways urged 438
Altitudes, Tests at High 413

Aluminum:
Composition of aluminum alloys, The 185
American Engineering Standards Committee, Works of the 76
"Analysis of Operation Costs of Aeroplane Lines", By William B. Stout 107

Appropriations:
Denby presents naval appropriation 148
French air budget 16
Increase in Italian aviation budget 232
North Island additions 523
651,000 Kroner for Swedish civil aviation 232

Articles:
"Absolute Coefficients and the Graphical Representation of Aerofoil Characteristics 441
"Aeronautic Roads", By Story B. Ladd. 563
"Aeroplane Flight Endurance" 490
"Are We Making the Most of Our Government Contracts" 99
"Cloud Flying", By Bruce Eytinge 461
"Deflection of Beams of Non-Uniform Section". 543
"Dynamometer Hub and the Flywheel of the Engine, The", By E. Everling. 464
"Effect of Zinc Plating on the Physical Properties of Streamline Wire, The". 368
"Employment of Airships for the Transport of Passengers, The", By Umberto Nobile 618
"Extract from a Report of the Resistance of Spheres of Small Diameter in an Airstream of High Velocity", By Capt. Toussaint and Lt. Hayer 199
"Factors Affecting Flight", By W. G. Landon 55
"Factors That Determine the Minimum Speed of an Aeroplane, The", By F. H. Norton 57
"Ground-Plane Influence on Aeroplane Wings", By A. F. Zahm 299
"How to Establish an Airway" 276
"Influence of Span and Load per Square Meter on the Air Forces of the Supporting Surface," By A. Betz 224
"Instructions to Pilots for the Use of Mixture Controls" 541
"Loads and Calculations of Army Aeroplanes", By Ing. Stelmachowski 9
"Methods for Preventing the Corrosion of Metal Parts of Aeroplanes" 369
"Tip for the Aircraft Manufacturer and the Prospective Operators of Commercial Aircraft Transportation Companies, A", By Com. E. G. Allen 297
Aviation in California 32

Aviation, Civil:
Austrian civil aviation 160
Aviation in Siam 160
Civil flying progress in Britain 40
Civil aviation in Australia 88
Civil aviation in the House of Commons 184
Civil aviation in Sweden 256
Civil air services in French Guiana 424
Civil air service in Argentina 424
Europe's way with flying 75
Half-Yearly report on British aviation 394
Some French civil flying figures 112

Aviation, Commercial:
Air Marshal Sir F. H. Sykes on 16
Aviation in the West Indies 448
American Aircraft, Inc., New Baltimore company. 562
Comemrcial aviation grants 160
Commercial aviation in Queensland 376
Commercial aviation in Bolivia 424
Commercial aviation in Morocco 596
Colombian services 424
Commercial aeronautics in Europe 524
Dutch Government helping commercial flying 424

Aviettes:
Aviette, The 374
Poulain, Gabriel, wins Peugeot aviette prize of 10,000 francs 436
Successful aviette test 365

B

Balance:
"Aeroplane Balance", By L. Huguet 345, 371, 417

Balloons, Dirigibles:
Aerocruiser Corp. have new type rigid dirigible 584
Comparative study of the efficiency of various dirigibles 470
"Roma" being erected at Langley Field. 609
Scientists discover German dirigible secret 77

ZR-2:
ZR-2 (known as R-38) carries 48 on first test 388
The ZR-2 (and the first dirigible) 435
To start on trans-Atlantic trip Aug. 25 537
Defects reported in 585
The ZR-2 disaster 607, 611
Beams: Deflection of beams of non-uniform section 543
Bermuda, Activities of Bermuda and West Atlantic Aviation Co. 365

Bernhard, J. L.:
"Radio Communication with Postal Aeroplanes" 105, 127, 154
Betz, A, "Influence of Span and Load per Square Meter on the Air Forces of the Supporting Surface" 224

Bills:
Air Legislation Pending 133
Hicks to push bill to license aircraft 293
Wadsworth introduces Federal Control bill 610
Bollard, Madame Adrienne, First woman flyer crosses the Andes 100

Bombing:
Aberdeen Proving Ground challenges Air Service stations to duplicate their bombing record 183
Army and Navy bombing tests, The 253
Army and Navy Board reports on bombing tests 583
Bombing the radio-controlled "Iowa" 303
Martin planes in bombing tests, The 317
Boulton, B. C., "Experimental Reinforced Plywood Truss Ribs", By (Illustrated) 539, 591

C

California:
Active aircraft companies in Southern California 102
Aeronautics in the California legislature. 365
Aviation in 33
Carburetor: The Hannen Carburetor, brief desc. 522

Carriers, Aeroplane:
Aeroplane carriers needed in the Navy 535
Denby wants 30 million for plane carriers 512
City Planning and aircraft 245

Code:
Aerial code urged 148
Aeronautical safety code 390

Colorado:
Airscape of Arkansas River at Pueblo Cover July 11
Pueblo flood relief expedition, The 489
Commercial Air Pilots' Assn., Meeting held Feb. 23 136
Communication: "Radio Communication with Postal Aeroplanes", illus. article by J. L. Bernard and L. E. Whittemore 105, 127, 154
Compass, "The Distant Compass", By Walter Friedensburg 587

Competition:
Awards in ship-board plane design competitions 316
Five new designs accepted by Navy 54
Navy Dept. now examining ship plane designs. 78
Navy designs 102

Contest:
German gliding contest 137
Speed contests in Chicago 197

Copeland, Harry D.
"Aerial Advertising from Maine to Florida". 7
Corrosion: "Methods for Preventing the Corrosion of Metal Parts of Aeroplanes". 369

Courses:
Aeronautics in the universities 147
Aeronautic ground schools 414
Aircraft armament course at Chanute Field 375
Airship pilots' instruction 279
American Airways, Inc., Plans of the 565
New flying school at Sao Paulo 160
University of California, Aeronautics at. 149
University of Detroit to have aeronautic course. 268

Covers:
Arkansas River at Pueblo, Airscape of July 11
"Bellarso", Residence of Mr. Frank N. Hoffstott, at Sands Point, L. I. Apr. 18
Bermuda, Hamilton Harbor May 23
Bush Country of Northern Ontario, Airscape of the Aug. 29
Coney Island, Airscape of Luna Park. May 9
Dartmouth, Eng., Airscape of July 18
Greenwich Country Club Golf Course. Apr. 25
Kensico Dam, Airscape of Aug. 22
Loening monoplane flying boat establishing an altitude record of 19,500 feet Sept. 5
Martin Bomber, The Glenn L. Mar. 14
Martin Bomber over the battleship "Pennsylvania." Will Congress Heed the Warning? Apr. 4
New York City:
American Art Museum, Airscape of. June 20
Cathedral of St. John the Divine, Airscape of the May 30
City College, Airscape of July 25
Grand Central Zone, Airscape of May 2
Harbor showing congestion of shipping due to engineers' strike, Airscape of section of June 6
Manhattan Island, Airscape of entire. Aug. 1
Niagara Falls taken directly over the brink at about 500 feet altitude, Remarkable view of Mar. 28
Oklahoma State Fish Hatcheries, Airscape of Aug. 15
Remington-Burnelli 30 passenger airliner making a landing Aug. 8
Residence of Mrs. O. H. P. Belmont at Sands Point, L. I. Mar. 21
Seaboard Consolidated Airlines, Aerial cruiser of the June 27
Speedway at Los Angeles, where the Aero Club of Southern California will hold its aerial meets this summer May 16
Traymore Hotel, Atlantic City, N. J. Apr. 11
Tulane University, New Orleans, Airscape of June 13
Villanova College, Devon, Pa. July 4
Crashes: "Aeroplane Crashes; Engine Trouble—A Possible Explanation", By Stanwood W. Sparrow 132

Curtiss Aeroplane & Motor Corp.:
"Curtis Aeroplane and Motor Corp. after the War", By R. M. Keys 205
Garden City plant and flying field, Airscape of 295

Curtiss, Glenn H.:
Curtiss-Herring suit 438
Heads movie studio company 438
Customs aerodromes, French 498

D

PAGE

Damblanc, Louis, Invents parachute controlled by radio which will drop bombs. 76
De Bothezat, Dr. G., "The Actual State of the Helicopter Problem", By........ 247
Delivery:
- Aerial newspaper delivery............ 486
- Aeroplanes used to deliver cream and rolls.............................. 424
- Fish by air delivery.................. 437
- Stevenson Overall Co. making shipments by air route......................... 390

Diehl, Walter S., "The Variation of Aerofoil Lift and Drag Coefficients with Changes in Size and Speed", By...... 518
Dierfeld, Benno R., "The Hawa Commercial Triplanes", By.................... 34
Dumping, Aero Club warns Congress against. 243
Duralumin motor boats by Zeppelin Works.. 422

E

Editorials:
- Consolidation of Aerial Age and Flying. 483
- Engineering from aloft................ 387
- Navy's urgent need for aeroplane carriers, The............................ 483
- Negativing Invasion.................. 387
- One-plane navy, The.................. 459
- Press on the Meneher-Mitchell Controversy, The........................... 339
- Way to Safer Flying, A............... 315
- ZR-2, The........................... 435

Egypt: Nile Valley surveyed from the air.. 548
Engines:
- Carburetion in internal combustion engines................................ 422
- Coupling of aero-engines............. 446
- Development of aeronautical engines by the Army and Navy................ 32
- Development of 700 H. P. Model "W" Engine 101
- "Dynamometer Hub and the Flywheel of the Engine, The", By E. Everling.. 464
- E. D. 1000 H. P. engine, The........ 255
- Gallaudet engine gear, The........... 590
- Heavy oil engine for aviation, A...... 328
- Installation of an aeroplane engine..... 14
- Italian engine design, An............ 137
- Measuring temperatures in internal combustion engines..................... 522
- Silencing aero engines............... 243
- Winter flying—engines............... 86

Engines, Types:
- Aeromarine, U. S. D. 8 cyl. engine completes test.......................... 389
- Benz 300 H. P. aero engines, desc. of.. 206
- B. M. W.
  - Investigation made on 185 H. P. motor at McCook Field................. 514
  - Performance test of Junker SL-6 with 185 H. P., B. M. W. engine....... 35
- Farman 600 H. P. engine, Brief desc. of. 302
- Fiat 300 H. P. Model A-12, Illus. desc. of 415
- Gnome Engine Works destroyed by fire. 524
- Hispano-Suiza to Wright, From........ 538
- Isotta Fraschini, Brief desc.......... 14
- Maybach: Investigation made on 300 H. P. motor at McCook Field........... 514
- Napier, The Napier "Cub"............ 16
- Packard model 1237 tested............ 366
- Salmson Type AZ9 300 H. P., Short desc. 350
- Sunbeam-Coatalen:
  - Cossack 350 H. P. engine used on the ZR2—photo 437
  - Cossack engine, Illus. desc. of....... 465
- Wright:
  - From Hispani-Suiza to Wright...... 538
  - Wright motor performance at Carlsstrom Field....................... 294
  - Wright motor stands 415 hours test.. 438

Everling, E., "The Dynamometer Hub and the Flywheel of the Engine", By........ 464
Expedition:
- Facts concerning flight to Ft. Norman, McKenzie District.................. 124
- Meteorological expedition to Jan Mayen. 280
- Mt. Everest expedition, The.......... 304
- Planes to be used in reconnaissance work in conjunction with expedition...... 413
- Pueblo flood relief expedition, The...... 489

Exploration: Lt. Alexander Pearson explores Grand Canyon...................... 340
Exposition (See also Shows, Aeronautical):
- Second Prague exposition to be held Oct. 22-30 596

F

Fabric, Thurston & Co., developing cotton.. 609
Fairchild, Lt. Muir S., "Experimental Night Flying by Flight Test Section, McCook Field", By.......................... 516
Fields, Aviation:
- Arkansas City has municipal hangar.... 174
- Curtiss Co. has two stations at Atlantic City.............................. 562
- Curtiss Buffalo Field................ 562
- Davenport Aviation Field opened....... 102
- Emmett Flying Field established at Cleveland, Tenn......................... 486
- Landing fields throughout Connecticut proposed by Hartford Aero Club..... 412
- Martin Field, The Glenn.............. 365
- New field at Greeley, Colo........... 414
- New flying field opened in Chicago...... 388

Fields, Landing:
- Hartford landing field............... 245
- Hills Grove landing field............. 461
- Municipal field at Staunton, Va........ 268
- New California landing field.......... 366
- Oneal-Walker Co. establish landing field at Oakland City.................... 375
- Seaplane landing at Yorktown, Pa...... 486

Fire: Prevention of fire by self-sealing tanks 564
Flying machine on the Alberto Wick principle 112
French:
- Aeronautical high council created...... 548
- Air services......................... 40
- Aviation firms are now consolidated.... 524

Friedensburg, Walter, "The Distant Compass", By.......................... 587
Fuel:
- Instructions to pilots for the use of mixture controls....................... 541
- K. L. Fuel System, The (Illustrated).. 515
- New gasoline substitute.............. 472
- "Simple Means for Saving Fuel on Traffic Flights", By E. Kook........... 439
- Synthetic Petrol: New German process.. 173

G

Garage in London, Aircraft............. 244
Gas mask for Navy, Improved............ 135
Gear: The Gallaudet engine gear.......... 590
Gerhardt, W. F.:
- "The Resistance of Aerofoils", By..152, 175

Germany:
- Aeronautics in German Universities.... 535
- Aircraft prohibition in............... 548
- Berlin fights air embargo............. 112
- German air lines run by time table...... 498
- Inter-Allied Commission and Germany on embargo.......................... 184
- More prohibitions for German aircraft.. 208

Gliders:
- Construction of gliders............... 110
- Germans turning attention to gliders of original and elaborate construction.... 549
- Soaring flight........................ 110

Ground Speed of an aeroplane in flight, New system of determining............. 610

H

Haggvist, F. E., "Aerial Photography and its Application to Modern Industries", By (Illustrated) 391
Handley Page, F., "The Handley Page Wing", By.......................37, 83
Hanscom, C. D., "Some Experiments on Thick Wings with Flaps", By........ 79
Hayer, Lt., "Extract from a Report of the Resistance of Spheres of Small Diameter in an Airstream of High Velocity", By.......................... 199
Helicopter:
- "Actual State of the Helicopter Problem, The", By Dr. G. DeBothezat.......... 247
- Austrian helicopter invented by Lt. Stefan von Petroczy tested.......... 524
- Brennan helicopter, The.............. 280
- Direct lift controversy............... 16
- French prize for helicopters.......... 208
- Hanschk helicopter, 312 miles an hour claimed for 438
- Helicopter prize, A.................. 256
- Helicopters and aeroplane-helicopters.. 374
- Helicopter in England, The........... 400
- Oehmichen helicopter, The............ 184
- Pescara helicopter, The.............. 134
- Pescara helicopter flies, The.......... 376
- Pescara helicopter, The.............. 424

Helithopter, Desc. of the Passat.......... 254
Huguet, L.—"Aeroplane Balance", By.... 344, 371, 417
Hydrography—Application of photography in 158

I

Imports and exports by air, British........ 16
Instruments:
- Bureau of Standards designs airship slide-rule 246
- Cloud-flying instrument board......... 301

Insurance:
- Aircraft insurance data............... 198
- Aircraft insurance for 1921........... 246
- Aviation risks declined............... 183
- Rain insurance for aircraft owners.... 294
- Travelers Insurance Co. publish booklet. 366

Italy:
- Aviation in......................... 596
- Italian fixtures for 1921.............. 16
- Italian aviation activities............ 232
- Italy increases its aviation vote........ 256
- Italian government orders machines.... 524
- Proposed new semi-rigid for.......... 232
- Sale of Italian material.............. 424
- Schneider cup race at Venice, The.... 596
- To have seaplane service between Brindisi, Corfu, Derna and Alexandria. 136

J

Japan:
- Aviation in......................... 472
- Buying aeroplanes on large scale in France 60
- Establishes flying harbor............. 328
- Imperial Japanese aviation............ 208
- New air lines to be established in..... 136
- Organizing aerial naval forces........ 64
- Receives part of German aircraft.... 256
- Tokyo civil air port................. 596

Jardine, Frank — "Aluminum Pistons," By 228, 250
Jehle, Ferdinand — "Aluminum Pistons," By 228, 250

K

Keys, C. M., "The Curtiss Aeroplane & Motor Corp. after the War," By.. 295
Knight, Wm., "Standardization and Aerodynamics," By...................... 343
Kook, E., "Simple Means for Saving Fuel on Traffic Flights," By........... 439

L

Ladd, Story B, "Aeronautic Roads," illustrated article 563
Landon, W. G., "Factors Affecting Flight," By 55
Langley's early experiments, Dr. Samuel P. 65
Laws:
- American Bar Assn. working on air laws 607
- American Bar Assn. urge uniform law for aero control.................... 608
- Federal regulation urged by Aero Club and M. A. A.................... 293

Legislation:
- Aeronautics in the California legislature 365
- Air legislation pending.............. 133
- American aviation policy............ 171
- American Bar Assn. working on air law for aero control................... 607
- American Bar Assn. urge uniform law for aero control................... 608
- Committee approves Navy air bureau.. 196
- Federal control of aviation to be discussed at S.A.E. summer meeting.. 220
- Wadsworth introduces Federal Control bill 610

Library, The Air Service................ 423
Life Preservers—Desc. of The Austin Life-Float 350
Lighthouse:
- Danish aerial lighthouse............. 256
- Luminous beacons for night flying..... 374

Lightning, Aircraft and.................. 571
Line drawings:
- Bristol Commercial ten-seater biplane. 487
- Caproni 3200 H.P. triplane.......... 103
- Curtiss type 18-T triplane, Scale flying model of.......................... 623
- Fastje compressed air motored tractor monoplane 597
- Hawa triplane F 10.................. 34
- Hydroaeroplane pontoons, 3 good designs for 233
- Imber tank, Some details of the...... 565
- K.L. Fuel System, Diagram of the.... 516
- Remington - Burnelli Airliner, The (R.B. 1) 421
- Spad-Herbemont Berline S-33 commercial biplane 488
- Waterman special racing monoplane.. 463

Lubricants for internal combustion engines. 60
Lynnway Aircraft Corp. has subsidiary company under the name of Lynnway Aerial Transportation Co........... 126
Lynnway Aerial Transportation Co. to engage strictly in commercial aviation work 126

M

Machine guns, Aircraft.................. 374
Manufacturers Aircraft Assn.:
- Elects officers 514
- Requests co-operation 585

Map:
- Aerial mapping of Mississippi swamp lands 78

PAGE
Aeronautical maps 470
Aviation road map—block system...... 563
Mapping the Orinoco Delta........... 232
Seaplanes and photographic mappings.. 87
Topographic mapping 414
Meets, (See also Tournament, Races):
Aero Club of Southern California July meet 221
Colorado's first aero meet was held July 30, 31, Aug. 1, 2.................. 536
Concordia, Kans.
Aero meet and show to be held at Concordia, Aug. 11, 12 and 13.... 514
The Concordia meet which was held Aug. 11, 12 and 13............. 608
Hartford annual meet................ 341
Kokomo, Ind.:
Aviation meet to be held at Kokomo, Sept. 20, 21 and 22............ 414
Monaco meeting, The 256
Nelson, Nebr.:
Aviation tournament to be held at Nelson 388
Omaha, Nebr.:
Pulitzer race to be held Nov. 3...... 565
Seymour, Ind.—Aviation held at...... 460
Wichita, Kans.—Air meet to be held.. 608
Metal:
About "Elektron" 158
Elektron metal 325
Discovery of the alloy used in framework of Zeppelin dirigibles........... 447
Meterology:
Aircraft and lightning................ 571
High altitude meteorological service by wireless 208, 570
Meteorology in the service of aviation 254, 350
Meteorological expedition to Jan Mayen 280
Model:
Addems compressed-air model, The, Also photo 305
Aeroplane characteristic and performance table eliminates mathematical calculations 525
Aeroplane models to be shown at International Aero Congress 549
"Aeroplanette" club suggested........ 525
British F.E. 8 Pusher, Photo of 2-ft. scale model of..................... 137
Burt, Landon, builds model of S. V. A. Also photo of model............... 65
Classification of model aeroplane types, The 113, 137
Compressed air engines:
Scale models propelled by........... 137
Compressed air engines built by C. H. Lea............................ 209
Contests:
Model contests for summer months.. 377
Some considerations on model contests 353
Curtiss 18-T Triplane, How to build a scale flying model of.............. 623
Designs for hydro-aeroplane pontoons, (Line drawings) 233
Drummond, Elmer, builds several models 41
Early model aeroplanes 161
Electric driven models, An idea for.. 425
Fastje, Carl H.:
Builds scientific models............ 401
Compressed-air motored model, The Fastje 425
Compressed-air driven tractor monoplane—photo 425
Compressed-air driven monoplane, Plans for building the Fastje.... 596
Flights made with W. F. Schult hydro-aeroplane model, Good.............. 473
Float construction, Model.........233, 257
Floats, How to repair leaks in model 425
Hydrovane models 329
Italian engine design, Ab............. 137
Langley's early experiments, Dr. S. P. 65
Lawrence indoor tractor model, The.... 281
Light weight hydro model designed by Arthur Heinrich (Also photo) 209
Loening racing monoplane built by R. Wilson Wilmer, Photo of flying model of 329
Model builder wants speed race...... 185
Notes on the correct use of silver solder, Some 209
Orenco Type D Fighter:
Flying model of the.............17, 41
Construction outline for building a 30-inch flying scale model of........ 17
Pasadena Elementary Aeronautics Club, Notes of the 377
Photo—90 seconds duration model built by Ernest A. Walen............... 549
Propeller:
Lecture by R. C. Hansen on model propellers 41
Model propellers tested in wind tunnel 89
Propeller pitch and its relation to the model 305, 329
Rules for designing propellers for models 549
Releasing parachutes from models.... 281

PAGE
Rolfe, Lt. D. P., Minnesota aviator desires to join model club 401
Shrinking fabric on wings........... 329
Sims, Rupert, builds model of Verville Packard 41
Turn tractor biplane model built by Jack Clark, president of Portland Model Aero Club 377
Use of "U" section steel for models, The 185
West Texas Model Club, Initial meeting of 473
Wing sections, Advisory Committee issues pamphlet on 425
Model building,—Opportunity for Texas model builders 281
Models built by Aerial Age Readers:
Galbraith, R. G., builds Verville Packard model and also incorporates novel ideas 89
Jaros, R., Illinois Model Aero Club member, builds S. E. 5 model....... 209
Mapes, Bruce A., builds S. E. 5 model 161
Mitchell, James, builds model of Curtiss JN4D-2 185
Rapien, Ralph, completes scale flying JN4 model (Desc.)................ 549
Scheler, S. I., builds flying model of the Lawrence military tractor.......... 449
Walen, Ernest A., builds single propeller pusher model 549
Montagu of Beaulieu, Lord. "The Possibilities of Airship Services," By...... 393
Mooring:
Grissell prize for mooring mast........ 400
Stabilizing raft for mooring airships over the sea 30

N

National Advisory Committee for Aeronautics:
American aviation policy............. 171
Committee issues pamphlet on wing sections 425
Group photo of entire committee..... 172
New fight looms over air policy....... 171
Special report of 178, 198
Navigation:
We lag in Air Navigation........... 51
Wireless to make navigation of air safer in future 183
Navy Department:
Bureau of Aeronautics formed........ 571
C-3 destroyed by fire................ 447
Carriers:
Aeroplane carriers needed 535
Denby wants 30 million for plane carriers 512
House Committee approves 269
Navy's urgent need for aeroplane carriers, The 483
Committee approves Navy Air Bureau 196
Design:
Awards in ship-board plane design.. 316
Competitive ship plane designs being examined 78
Five new designs accepted in Navy Dept. new design competition.... 54
Navy designs 102
Seaplane tender U. S. S. Wright for the Navy, The....................... 344
War College remains at Newport.... 571
Netherlands Aircraft Corp. Fokker:
Fokker to build American planes....... 486
Fokker may establish factory in Hartford 537
New Jersey passes aerial regulations...... 100
New Zealand, Aviation in................ 328
Newspapers:
Aerial newspaper delivery............. 486
Aeroplanes carry newspapers to capital 4
German dailies by air................ 352
Night Flying:
"Experimental Night Flying by Flight Test Section, McCook Field," By Lt. Muir S. Fairchild 516
Interesting night-flying experiments 436
Lighting installations for............ 110
Luminous beacons for night flying.... 374
Night flying tests..................... 280
Noack, W. G., "Aeroplane Supercharges," By 272, 322, 347
Nobile, Umberto:
"The Employment of Airships for the Transport of Passengers," By...... 618
Norton, F. H., "The Factors that Determine the Minimum Speed of an Aeroplane," By 57

O

Observation:
Aerial observation for the Navy...... 40
Aerial regulation of heavy field artillery fire 621
Optical principles of illuminating engineering 14
Oregon aeronautic board 388
Organization of French Aeronautics....... 367

P

PAGE
Panama Canal:
Canal defenses 111
Congressional Committee inspect canal defenses 159
Patrol, Forest:
Aerial forest patrol 78
Army forest patrol 231
Dirigibles superior for forest fire prevention 570
Forest fire patrol work 621
Night air patrols to combat forest fire prevention 570
30 cadets volunteer for forest fire patrol duty 279
Philippine Islands:
Engineering from aloft 387
Government to relinquish its air service 595
Philippine government establishing an air service 208
Railroad reconnaissance by aeroplane.. 399
Photography, Aerial:
"Aerial Photography and Its Application to Modern Industries," by F. E. Haggvist 391
Aerial photography in farm management 399
Air Photo Co. organized to specialize exclusively in aerial photography.... 413
Aircraft for survey purposes.......... 99
Application of photography in hydrography 158
"Kodaking from an Aeroplane," by Seymour Wemyss Smith................ 589
Piloting: "Airship Piloting," Paper by G. H. Scott 158
Pistons—"Aluminum Pistons," By Frank Jardine and Ferdinand Jehle.....228, 250
Police, Aerial:
Aerial Patrolmen Next?.............. 51
Dallas aerial police 609
Oklahoma City aerial police........... 245
Problems in aeronautical research, Some.. 14
Propeller:
Correction of propeller torque, The..... 89
New type propeller invented by Bourke 546
Reversible steel propeller............ 207
Publications:
National Physical Laboratory issues 132 page report 472
Official journal for Czecho-Slovakia.. 88

Q

Queensland, Commercial aviation in....... 376

R

Radiator, The Lamblin.................. 134
Radio:
Activities, Radio 595
Army planes can talk to plant 50 miles away 523
Daily weather report for aviators by radio 298
"Radio Communication with Postal Aeroplanes," illus. article by J. L. Bernard and L. E. Whittemore.... ....105, 127, 155
Radio-controlled car, More about the. 595
Radio-controlled torpedo boat to be constructed 63
Use of radio in the Air Service, The. 523
Wireless to make navigation of air safer in future.................. 183
Record:
Argentine height record established June 10 by Sargento primero Barrufaldi in a Bristol machine............. 572
Belgium altitude record of 25,943 ft. made by M. Lovadina............ 498
Five leap 2,000 feet and set parachute record 29
Haldeman, Geo. W., makes new tailspin record 53
Kirsch, Lt., makes new altitude record of 34,768 ft...................... 486
Kirsch, Georges, reaches height of 32,153 ft. on June 14................ 498
Kemper, Miss Edna, makes new altitude record for women in an attempt to regain speech 197
Lemon, Frederick, establishes low parachute record of 125 ft............. 364
McCulloch, Lt. Com. David, breaks altitude record for hydro machines Aug. 16, reaching height of 19,500 feet.. 584
Quintuple parachute jump of 2,100 ft. made on March 9................. 111
Two-man altitude record of 34,150 ft. made by Lt. J. A. Macready....... 351

PAGE

Regulations:
New Jersey passes aerial regulations.. 100
Swiss air regulation 304

Report:
N. P. L. Report, The................ 472
Report on Atlantic Fleet naval squadron 159
Report of joint Army and Navy Board on bombing and ordnance tests...... 614
Resume of progress of aeronautic matters in Congress 342
Special report of the National Advisory Committee for Aeronautics......178, 198
Topographic mapping 414

Rescue—Seaplanes rescue stranded party off Bahama Islands 172

Resistance:
Air Resistance....................... 499
Resistance of Spheres of Small Diameter in an Airstream of High Velocity, By Capt. Toussaint and Lt. Hayer 199

Ribs—Experimental Reinforced Plywood Truss Ribs......................539, 591

Roads—"Aeronautic Roads," By Story B. Ladd (Illus. article)................ 563

Routes, Aerial:
Air route over desert between Palestine and Mesopotamia 524
Cairo-Basra air scheme 424
Pacific to Amazon air route reconnaissance 64
Palestine to Bagdad 256
Palestine to Mesopotamia by air, via the Arabian Desert 498
Plan use of Warrior River as seaplane route 173
Route between Los Angeles and Salt Lake City ready for aviators....... 29
Spanish air routes for 1921........16, 304

S

S. A. E.:
Dickinson, Dr. H. C., manager of new research department 535
Federal control of aviation to be discussed at S. A. E. summer meeting 220
McCook Field entertains engineers.... 294
Meeting of Dayton Section to be held March 22 30
1921 personnel of Aeronautic Division 30
Semi-annual meeting held at West Baden, Ind. 198
Washington S. A. E. meeting.......... 126

Safety:
Curbing reckless aviation............ 560
Safety precaution for aeroplanes....... 546
Safety of flying (Report by Manufacturers Aircraft Assn.)............. 412

Screw—Theory of propulsive screws, marine and aero 254

Shaw, Sir Napier—"The Artificial Control of Weather," By 203

Siam, Aviation in....................160, 352

Signposts for airmen 16

Smith, Seymour Wemyss—"Kodaking from an Aeroplane," By................. 589

Smuggling:
Aeroplanes used for smuggling drugs.. 245
Dog smuggling by aeroplane 197

Sparking plug with revolving electrode.... 422

Sparrow, Stanwood W. — "Aeroplane Crashes: Engine Troubles—A Possible Explanation," By.............. 132

Speed—"The Factors that Determine the Minimum Speed of an Aeroplane," By F. H. Norton..................... 57

Standardization:
International standardization 392
"Standardization and Aerodynamics," By Wm. Knight 343

Statistics:
Aerial Lines carry 2,007 passengers in three months 586
Aeromarine Airways 413
Australian air service 352
Census of manufacturers............. 342
German commercial flying statistics.... 280
Handley Page records 352
Long mileage of Curtiss planes........ 414
Record of French aviation............ 256
Safety of flying (Report by Manufacturers Aircraft Assn.) 412
Swiss military Air Service records.... 596
Wright Aeronautical Corp. declares dividend 536

Stelmachowski, Ing., "Loads and Calculations of Army Aeroplanes," By..... 9

Stout, Wm. B., "Analysis of Operation Costs of Aeroplane Lines," By...... 107

Streamline Wire—"The Effect of Zinc Plating on the Physical Properties of Streamline Wire" 368

Subsidy:
Italy increases its aviation vote...... 256
Spanish subsidy for air lines......... 64

PAGE

Supercharger—"Aeroplane Superchargers," By W. G. Noack...........272, 322, 347

Surveying:
Aerial survey of cyclone swept timber zone of the Olympic Peninsula.... 135
Aerial surveying in India............ 280
Aerial surveying of the Fraser Valley 304
Army planes have begun survey of Olympic Peninsula 159
Colemanite survey from air........... 365
Efficiency and Economy of aerial survey 267
Engineering from aloft............... 387
Mapping the Orinoco Delta........... 232
Nile Valley surveyed from the air.... 548
Railroad reconnaissance by aeroplane, Philippine Islands 399
Survey of the River Congo........... 328
Thousands of dollars saved to the public by aerial survey................ 321

T

Tanks—Prevention of Fire by Self-Sealing Tanks 564

Texas—Dallas aerial police 609

Therapeutics:
Aeroplane and therapeutics, The...... 195
Kemper, Miss Edna, makes new altitude record for women in an attempt to regain speech 197
Renz, H. A., gets back power of speech by aeroplane trip................... 101
Verner, Wilfred, regains his speech in flight 436

Tinker, Lt. C. A.—"The First American Commercial Dirigible Line," By...... 202

Tire development, Aeroplane 342

Torpedo Boat to be constructed, Radio controlled 63

Tours—Trips to Alpine resorts promised for next summer 561

Toussant, Capt.—"Extract from a Report of the Resistance of Spheres of Small Diameter in an Airstream of High Velocity," By 199

Traffic:
Airship guides traffic at derby....... 316
"Simple Means for Saving Fuel on Traffic Flights," By E. Kook........ 439

Transportation:
Aeroplane system to link Bagdad with Jeruselum 112
Airways where no roads exist—Air service between mines of Djoko Punda and Kinchassa 424
Amsterdam service doubled........... 352
"Analysis of Operation Costs of Aeroplane Lines," By Wm. B. Stout.... 107
Australian air services, New.......... 548
Bavarian Air Lloyd reopens.......... 160
Belgian-Congo Air service............. 40
Berlin-Leipzig-Munich-Augsburg air service 304
Berlin-Russia air service 548
Congo airway scheme 208
Eastern Mexican Aviation Co. formed in Tampico 197
German air traffic with Lithuania and Poland 184
Handley Page service discontinued.... 88
Indianapolis-Chicago air service to start 172
International Air Transport Co. and Lloyd Eastflight Co., new German companies 184
Levantic seaplane circuit, A.......... 136
London-Moscow route 352
Morocco service, Acceleration of...... 572
Munich-Lake Constance air service..... 352
Peking-Shanghai air service........... 304
Planes to link trade with Russia...... 462
Prague-Warsaw air line.............. 304
Regular air service to be inaugurated between London and Amsterdam.... 622
Rotterdam-Dortmund air service 352

Transportation, Air Lines:
Aerial Bradshaws 411
Aerial Navigation & Engineering Co. formed in Denver to operate Service between Denver and Chicago.... 462
Airway record, An (Britian to the Continent) 435
Bayonne-Bilbao-Santander air service.. 232
British Imperial Air Service.......... 524
Civil air services in French Guiana.... 424
Facts concerning flight to Ft. Norman, MacKenzie District 124
"First Commercial Dirigible Line, The," By Lt. C. A. Tinker............. 202
French services, The................ 411
Gulf Aero Transport Co. organized at New Orleans 366

PAGE

Hudson Valley Air Lines organized.... 6
Iceland-British Isles-Denmark service.. 147
Italian seaplane service to be started between Brindisi, Corfu, Crete, Derna and Alexandria 136
Japan, New air lines to be established in 136
London-Paris air service, Resumption of 136
Palestine-Bagdad service 147
Paris-Warsaw Aero Line is inaugurated 173
Paris-Warsaw air service 208
Seaboard Consolidated Airlines establish service between New York and Washington 608
Spanish subsidy for air lines........... 64
Stockholm-Reval air service........... 572

Transportation, Commercial:
Air route for Alberta................ 245
Anglo-Dutch air service, with connections to Copenhagen 52
Commercial Airship Syndicate, Inc. to operate dirigible between St. Louis and Chicago 246
German air traffic with Lithuania and Poland 352
N. Y.-Pacific airship air service plans not to be delayed................ 609
Olympian Airways organizing routes, The 6

Transportation, Passenger:
Aeromarine service in the north........ 222
Adriondacks by aeroplane............. 340
Air Liner City of London has carried 10,600 passengers 548
Great Lakes Airways, Inc. organized in Cleveland 100
New field at Greeley, Colo. 414
North American Aerial Transportation Co. makes sight-seeing tours over Washington 342
Peking-Shanghai air service 208
Premier Air Line organized in Clarksburg, W. Va. 54
Seaboard Consolidated Airline to establish regular service between Atlantic City and New York.............. 293
Ten American vogagers want air buses to Paris 268
Transatlantic passengers use French service 389
United Airways, Inc., organized with offices in Washington, D. C......... 198
United States Airways, Inc., plan week-end flights to Thousand Islands..... 268
Westchester Aerial Dispatch organized. 342
Wood Aerial Transportation Co. of Pensacola, Plans of..................... 78

U

United States Airways, Inc., plan week-end flights to Thousand Islands.......... 268
University of California, Aeronautics at 149

Universities:
Aeronautics in the universities........ 147
Aeronautics in German universities.... 535
Aeronautical course at University of Detroit 537
University of Detroit to have aeronautic course 268

Uruguay—President of Uruguay flies...... 160

Uses:
Aeroplane and therapeutics, The...... 195
Aeroplane as an aid in the sanitation of mosquito-breeding areas, The...... 269
Aeroplanes bring late passengers to ships 269
Canada's first merchandise by air.... 5
Carry diamonds by air, To.......... 244
Carry food in British strikes, Airships may 124
Carry newspapers to capital, Aeroplanes 4
Catch hunters, Aeroplanes 4
Chicago professor studies Pyramids from an aeroplane................ 197
Deliver cream and rolls, Aeroplanes used to........................... 424
Do useful work in France in dealing with the grasshopper plague, Aeroplanes 622
Fish by air delivery................ 437
Fish patrol in Iceland, A............ 160
Freight cars moved by aero motors.... 198
Fresh flowers by air to England...... 352
German dailies by air................ 352
Hartford Mayoralty makes call at Springfield by aeroplane........... 172

PAGE

Inspecting Queensland sheep by aeroplane ... 472
Insurance agency uses plane for delivery of claim checks ... 102
Logan, Chas. E., makes business trips by plane ... 76
N. E. A. by aeroplane aid beat all competitors with fight pictures ... 485
Planes urged to hunt for vanished fleet 389
Plants mines by aeroplàne ... 4
Pueblo flood relief expedition, The ... 489
Rescue stranded party off the Nahama Islands, Seaplanes ... 172
Save dying woman, Physician travels by aerial mail to ... 388
Saves a patient, Goes 150 miles by air and ... 340
Seal location by aeroplane ... 414
Seeing New York in Aeromarine sightseeing busses ... 317
Seek for oil in South America, Planes to 173
Shackleton, Sir Ernest, will use plane in the Antarctic ... 585
Shopping by aeroplane ... 524
Spanish bull-fighter, Fortuna, uses Bristol Tourer to keep an engagement ... 448
Spot targets for fleet, Planes leave station to ... 87
Spraying trees from an aeroplane ... 586
Stevenson Overall Co. making shipments by air route ... 390
To print a newspaper while flying in clouds ... 77
Tours to advertise "Style Week," Aeroplane ... 4
Transatlantic passengers use French service ... 389

W

PAGE

Wales, Prince of, Becomes Hon. President of Aero Club of Canada ... 64
Welding, Progress in electric seam ... 446
West Indies—Aviation in the ... 448, 524
Whittemore, L. E., "Radio Communication with Postal Aeroplanes"—Illus. article by ... 105, 127, 154
Wind Channel:—Aero-Technical Laboratories 374
Wind Tunnel:
- Largest wind tunnel in the world installed in the aerodynamical laboratory of the Zeppelin Co ... 472
- McCook Field wind tunnel, Illus. desc. of ... 319
- Model propellers tested in wind tunnels 89
- New Bureau of Standard tunnel ... 437
- Velocity Determination in McCook Field Wind Tunnel ... 542

Wing:
- Advisory Committee issues pamphlet on wing sections ... 425
- "Experiments on Thick Wings with Flaps, Some," By C. D. Hanscom ... 79
- "Ground-Plane Influence on Aeroplane Wings," By A. F. Zahm ... 299
- Handley Page Wing:
  - "Handley Page Wing, The," By F. Handley Page ... 37, 83
  - Further tests on the Handley Page wing ... 448
- New high-lift wing ... 340
- Shrinking fabric on wings ... 329
- Sperry Monoplane Wing, The ... 270
- Undercarriage design with reference to high wing-loading ... 446
- Wings with variable camber ... 89

Wireless:
- High-altitude meteorological service by wireless ... 208, 570
- General Squire's work in Paris ... 590
- Wireless to make navigation of air safer in future ... 183
- Wireless stations on airways ... 206

Wood:
- Effect of varying the number of plies in plywood ... 30
- Plan to reduce the time and cost of air seasoning wood, A ... 567
- Properties of ordinary wood compared with plywood ... 6
- Stresses in laminated wood construction 206
- To tax Spruce Corporation ... 126

World's Board of Aeronautical Commissioners, Inc:
- Membership increased ... 173, 244, 269, 293, 388, 461
- Plans of ... 461

Wright Aeronautical Corp:
- Declares dividends ... 536
- Publishes house organ ... 538

Wright, Orville:
- Group photo with National Advisory Committee ... 172
- Photo and write-up ... 61

Z

Zahm, A. F.—"Ground-Plane Influence on Aeroplane Wings," By ... 299
Zeppelin Company:
- Duralumin motor boats ... 422
- Largest wind tunnel installed in aerodynamical laboratory of ... 472
- Zeppelin Co. negotiates for French financing ... 54

Zinc Plating—"The Effect of Zinc Plating on the Physical Properties of Streamline Wire" ... 368

AERIAL AGE WEEKLY

Vol. 13, No. 1 MARCH 14, 1921 10 CENTS A COPY

The Glenn L. Martin Bomber

Aviators to Bomb Ex-German Warships in Tests

PUBLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
Subscriptions: Domestic, $4; Foreign, $6. Entered as second-class matter March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

AN OPPORTUNITY EVERY AERONAUTIC ENTHUSIAST HAS BEEN WAITING FOR

THROUGH an arrangement which we have consummated with the organization that purchased large quantities of Air Service Propellers, we are enabled to present an opportunity to every reader of Aerial Age to secure a full size aeroplane propeller—an admirable souvenir that every aeronautic enthusiast will want to secure. Some of the uses to which these propellers may be put are indicated on this page. They originally cost from $85 to $150 each, and are now obtainable, together with a subscription to *Aerial Age*, for a ridiculously small price.

To each person sending us a subscription for three years (or three subscriptions for one year each) and enclosing their check for $15.00, we will send a two-bladed propeller, properly cased, freight charges to be paid on delivery by the addressee. If a four-bladed propeller is desired a check for $18.00 should be remitted for the subscriptions and propeller.

................................ORDER BLANK:................................

Please find my check enclosed herewith for $.........., for which enter subscriptions, and send propeller as per enclosed memorandum.

Name..

Address..

AERIAL AGE WEEKLY, 280 Madison Ave., New York City

G. DOUGLAS WARDROP
Editor
C. D. THOMSON
Associate Editor
B. C. BOULTON
Contributing Technical Editor
LESLIE V. SPENCER, M.E.
Contributing Technical Editor
NORMAN E. JENNETT
Art Editor
H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

Published weekly by THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIII NEW YORK, MARCH 14, 1921 NO. 1

AERIAL AGE'S SIXTH ANNIVERSARY

TODAY Aerial Age celebrates its sixth birthday. We believe that our six years of existence has done much to stimulate and increase aeronautic business, and to increase interest in and respect for the aeroplane and internal combustion engine as an adjunct of modern warfare, and as a medium of speeding up commerce and the intercommunication of nations. With but a glance backward, Aerial Age looks forward to service of ever increasing importance for the aeronautic industry.

Following are a few of the letters of greeting which we have received:

Secretary of the Navy Josephus Daniels writes: "The progress of Naval aviation since the beginning of the World War has convinced all open-minded people that the conquest of the air is to be the outstanding achievement of the century. We are but on the threshold of the wonderful progress and improvements which this generation is to witness. We not only will have 'airy navies battling in the central blue,' but we will have mail routes all over America and all over the world carrying the mail, and the express companies are destined to find that unless they adopt aviation they will lose their trade. With best wishes for the important part your paper is taking in this improvement."

Godfrey L. Cabot, president of the Aero Club of New England, writes:

"In connection with the Sixth Anniversary on the 14th of March of the founding of your paper, permit me to express the appreciation of the members of the Aero Club of New England of the very active promotion of all things Aeronautical that you have consistently carried on from start to finish.

"We hold that the Aeronautical Branch of Military operations is an essential part in the National Defence of this Country. We know, as does everybody who has made a study of the matter, that it is the branch in which the United States should surpass all other nations and the administration of which was, on the whole, most discreditable to this Nation in connection with the late World-War.

"Long may you live to continue your crusade for American support of what might be called an American Science, for the Art of Aviation at all events, had its origin in this country."

Charles M. Manly, pioneer aeronautic engineer and associate of Professor Langley, writes: "I am delighted to be able to extend to you and to Aerial Age Weekly, on the occasion of the celebration on March 14 of its Sixth Anniversary, my sincerest congratulations on its previous record of accomplishment, and my heartiest good wishes for the coming years, which are certain to see the field of Aerial Transportation broadened into that of a most important industrial enterprise.

"When I recall the bitter ridicule and vituperation which were heaped on Dr. Langley during the pioneer days and think of his labors 'to make the world safe' for those developing aviation, I can indeed congratulate you and your paper that, although your problems are no doubt many and difficult, you do not have to labor under such a handicap as was our portion at that time.

"We have but to recall the great achievements of the Great War to be impressed with the importance of cooperation in building up the great industry of Aerial Transportation, and to realize the strength of the observation of the late Elbert Hubbard that 'The power of coöperation is man's highest manifestation of intelligence and wisdom.'"

G. M. Williams, general manager of the Dayton-Wright Biplane Co., writes:

"I should like to take this means of congratulating you and the staff of Aerial Age on the completion of six years aeronautical activity.

"At this time when the position of aeronautics in this country so hangs in the balance, it is gratifying to have such publications as Aerial Age as a stimulant to universal interest in such an important matter. We hope your efforts will be as successful in the future as in the past and in this connection it is a pleasure to wish you the best of prosperity."

Harry Bowers Mingle, formerly president of the Manufacturers Aircraft Association, writes: "It is with extreme pleasure that I take this opportunity of extending to you my heartiest congratulations on the Sixth Anniversary of the Aerial Age Weekly.

"Appreciating the fact that there have been many diversities of opinion as to the work accomplished by each and all of us engaged in the Aircraft program and its development, I cannot but say that to Aerial Age is due its share of credit for spreading propaganda that has made 'Aeronautics' what they are today in the public mind. You and your associates are certainly to be congratulated.

"Aerial transportation, in my opinion, is dependent upon two developments which must be carried through, even before planes of safety can be marketed, and these two points are:

"FIRST: National legislation covering Air Navigation.

"SECOND: The hystematic development of *landing fields* on a constructive and continuing business basis.

"I trust that Aerial Age may continue, as in the past, to point the way to accomplishing these ends."

The News of the Week

Aeroplanes Carry Newspapers to Capital

An enterprising innovation in the realm of publicity was a special inaugural edition of the New York *Times,* which arrived in the National Capital by aeroplane early March 4th and was placed on sale in plenty of time for the first downtown crowds to gather.

This paper, which was labeled "Airplane Edition for Washington," consisted of thirty-two pages.

The first consignment of 700 copies was piloted through the early morning clouds by Richard H. Depew, Jr., in a Curtiss Oriole. He made the journey from the Curtiss Field to College Park, near Washington, in net flying time of 2 hours and 28 minutes. The distance is 217 miles, so that his speed was ninety-two miles an hour. He began his flight at 6:27:30 a. m. and was above College Park at 8:52. A few minutes later another machine arrived, piloted by Charles S. Jones.

The route from the starting field was over Fort Hamilton, across the Narrows, down the coast of Staten Island, over Perth Amboy, Trenton, Philadelphia and Wilmington, reaching the Chesapeake Bay at Elkton, Md., down the Chesapeake to Baltimore, and then to College Park, which is the Washington stop of the air mail service.

Italian Airship Handed Over

On March 4th officials of the Italian Government handed over to Major John G. Thornell of the American Air Service, the airship Roma, which was recently purchased from the Italian Government by the United States. A short trial flight of the airship preceded the ceremony of transfer.

Aeroplanes Catch Hunters

Dixon, Ill.—Federal game wardens are using aeroplanes to run down violators of the closed Spring season on ducks.

Six hunters were arrested near Erie, in the Rock Island district, recently. The wardens in a plane swooped down on the hunters, who were fined $35 each.

Plants Mines by Aeroplanes

A new method of planting mine fields, involving the use of aircraft and a special type of mine equipped with a parachute, has been the subject of recent experiments conducted by the navy in Chesapeake Bay.

The mine used is the invention of Charles Kee, a mechanical engineer of Portsmouth, Va. The mechanism consists of the mine, anchor, cable and silk parachute. Large numbers of aeroplanes, each carrying several mines, can be sent over the area to be mined and the devices dropped at regular intervals. The parachute eases the descent to the exact spot selected, and the instant the mine hits the water the parachute is detached and floats away, to sink later. The mine anchor sinks to the bottom, carrying the mine with it, and a predetermined amount of cable is automatically released, allowing the mine to rise to the required distance from the surface. Mines of any weight may be used up to the lifting capacity of the aircraft.

The system is designed for use in both offensive and defensive operations and is intended to replace the mine-planter for small fields.

Wants Cabinet Member for War, Navy and Aviation

Washington.—Creation of a Federal "Department of National Defense," in which the army and navy and a third division having to do with aviation would be combined under one Cabinet member, has been recommended to President-elect Harding by Senator New of Indiana, generally regarded as one of the President-elect's most trusted advisers.

Chairman Wadsworth, of the Senate Military Committee, said that he had never discussed the question of consolidating the army and navy with either Mr. Harding or former Senator Weeks of Massachusetts, who is to be Secreary of War.

Aeroplane Tours to Advertise "Style Week"

With a view to attracting the attention of the people of Wisconsin to the importance of "style week" as a state and civil benefit, the Milwaukee *Sentinel* has arranged to tour the state with an aeroplane and drop some interesting propaganda from the air. A special arrangement has been made with the Curtis Wisconsin Company and the *Sentinel* has secured the services of Pilot Gillis Meisenheimer for the entire week.

Arriving at each city, the plane will circle over the downtown district, dropping thousands of the elaborate invitations urging the presence of citizens in Milwaukee on the occasion of Style Week.

Not only will the people in these towns receive invitations to Style Week, but there will be unusual favors also which will be dropped from the plane with the invitations.

National Air Tournament to Be Held in Florida

The national southern air tournament will be given at Clearwater Bellfair, Florida, March 26-27-28, 1921. This event is the second of a series of air tournaments given at four points of the country. The first tournament was given near Los Angeles in December, the third is expected to be in the metropolitan area in June and the fourth in the central west in July.

These tournaments are taking the place of the aeronautical shows of the past, and given under actual flying conditions, show aircraft in action and, it is thought, will be the means of national propaganda for more adequate support of aircraft for commerce and national defense. The tournaments are supported by the manufacturers and the air service of the army and navy.

Major Ralph Royce, commanding officer of Carlstrom Field, has approved the plans for the southern tournament, and will have personal charge of army participation. It is hoped that the naval air service will make a strong showing as the west coast of Florida is potential seaplane territory, and there is a great deal of interest among permanent and visiting residents of the south.

The program will consist of two days for land planes, with races around a 20-mile course, formation flying, parachute contests and other events. March 28th is Seaplane Day, and as the naval base at Pensacola is well supplied with material it is expected that the flying boat will be a leading feature.

The Hotel Belleview will entertain the army and navy pilots and the city of Clearwater will provide accommodation for the personnel. The participation and admission is free to all. Walter Hempel, who has handled the national aeronautical shows, is in charge of the tournaments, and headquarters have been opened at the Hotel Belleview, Belleair Heights, Florida. It is expected that at least one hundred thousand people will witness the tournament events and inspect the fifty or more planes, motors and other educational features on display.

The railroads will run special trains from as far north as Jacksonville and it is expected that the thousands of northern visitors will take home an entirely new impression of aviation, its safety, utility and necessity for national defense.

Calls Air Taxi As a Joke and Now He Has to Pay

For the first time in the history of the city, so far as the records show, a judgment has been awarded against a defendant who failed to pay an aerial taxicab bill.

The suit came up recently in the Municipal Court before Judge John R. Davies. C. A. Lomas was the defendant. It was alleged that Lomas did not believe it possible to hire an aeroplane taxi, and on August 4 last, ordered one "just for a joke." The aerial taxi was sent to the

The Sperry Messenger aeroplane, capable of 32 miles to the gallon of gasoline and 95 miles per hour high speed

pier at Eighty-fourth Street and North River, but Lomas did not arrive.

A verdict of $25 and costs was given by Judge Davies against the defendant, the court ruling that an aeroplane taxi service is no more of a joke than motor service on the ground.

The Rockaway Point Controversy

An enemy battleship could lie beyond the horizon and bombard Manhattan with sixty tons of deadly gas shells an hour, according to one of the arguments made recently by naval officers before the Sinking Fund Commission in urging that the city cede ninety-four acres of the 267 acres of Jacob Riis Park, at Rockaway Point, to the Federal government for an aviation station.

Rear Admiral H. P. Huse, the new commander of the Third Naval District, told the commissioners that if the navy could not get this land for an aviation station New York could not be properly protected.

"It is as an expert that I tell you this," said the Admiral. "New York will have to accept the responsibility. The land requested is necessary for the defense of the city. Congress will not buy it. If you do not cede the land there will be no air station. That is final."

Representatives of parks and playground associations and other civic bodies were present to oppose the grant, and all said that it had been a struggle to get the park and they did not want to lose any part of it now. Dock Commissioner Hulbert favored granting the application, saying that the station would add to the children's interest in the park. Rear Admiral J. H. Glennon, formerly commandant of the district, said the station was a necessity and that the city would need tremendous forts at Rockaway Point.

Further consideration of the matter was laid over for two weeks.

Air Service Enlistments Suspended

As a result of recent publicity to the effect that the Air-Service was in a position to train about 500 civilians as flying cadets, hundreds of communications were received requesting application blanks and other data pertaining to this training.

The legislation passed by Congress prohibiting further enlistments in the Army until the enlisted strength is reduced to 175,000 has also been construed to stop the further enlistment of flying cadets. This office of the Chief of Air Service is now sending replies to these inquiries to the effect that it will not be possible to enlist civilians for this training until the Army is reduced to the above strength. It is estimated that no further enlistments can therefore be made until about the close of this calendar year.

Guide for Fliers Who Make Forced Landings

The following letter from Mr. W. P. Bullock of Salt Lake City, which has been forwarded from the Air Mail Service of the Post Office Department to the Chief of the Army Air Service, is called to the attention of all aviators.

"From time to time I have noted in the papers very graphic accounts of Aviators who, through the misfortune of having to make forced landings, have wandered aimlessly around in search of natural and known objects, and only yesterday the press gave an account of Lieut. Pearson who was lost for three days, after alighting in a gulch or ravine in Mexico.

"Having followed Engineering for many years I might be able to impart to your Department a rule that has served me well at various times when I was lost and when a pocket compass or a given direction was of no value.

"My rule has been to follow the dry creek or the natural downward slope, regardless of direction, and this will always lead to a larger stream and that to a river or known water course. There are few places where the water slope cannot be traced; possibly in the Staked Plains of New Mexico and Western Texas it would be hard to do so, but in the case of Pearson, he says he landed in a ravine, and thinking the Rio Grande River ran East and West at that point, he traveled North and South in an effort to intercept it. But after three days of aimless effort he discovered he was moving parallel with the River as it ran North and South at that place. Now this was the same experience of the Balloonists who alighted in Canada. They depended upon a compass, and traveled several days parallel with the Moose River. This would have been impossible if they had followed my rule, of moving always downward first with the very faintest trace of a draw or gully until that directs the wanderer to a larger stream and that in turn to the River, which is always skirted on each bank with roadways leading to settlements."

Canada's First Merchandise By Air

The first cargo of merchandise ever landed in Canada by air was brought in via aeroplane by Colonel W. G. Barker, V.C. The goods were taken from New York and landed in Toronto.

"Glencoe House," residence of Mr. Thomas McKean, Rosemont, Penna., photographed by Captain Suydam of New York

The AIRCRAFT TRADE REVIEW

Hudson Valley Air Line Organized

The Hudson River, which has been the background of so many events significant in the growth and development of the United States, is again to be the scene of a new epoch in transportation history. The Hudson Valley Air Line, a corporation organized by prominent business and professional men of Albany, will inaugurate a hydroplane express service between New York and Albany, beginning early in the spring.

The line will operate two flying limousines of the HS-21 Navy coast patrol type. These planes will carry five passengers and 500 pounds of mail and express. They will make the trip in 90 minutes from the company's float at the Municipal Pier at Albany to 80th Street, New York.

The Hudson Valley Air Line also plans to operate a "local" service between Albany and New York. The "ships" of this fleet will be of the same type as the express boats and will make scheduled stops at Hudson, Kingston, Poughkeepsie and Newburgh.

Don M. Campbell, who achieved a brilliant record as a lieutenant in the United States Army Air Forces during the World War, will be in charge of the mechanical and service departments. He also will be chief pilot of the Line.

The demand for a safe and swift service between Albany and New York is constantly growing and business men in the Albany district are solidly behind the new venture.

The boats of the Hudson Valley Air Line will be equipped to give every comfort and convenience to passengers. Under the guidance of Mr. Campbell the Line will employ and train only the highest grade pilots. Then, too, Albany is the hub of the summer tourist traffic in the East. The fame of the beauties of the Hudson River have been spread broadcast and backers of the Line are confident that a "flying trip to New York" will be one of the vacation stunts next summer.

Barr's Flying Circus to Orient

Barr's flying circus of Venice will welcome at least some of the participants in the "first aerial derby around the world" and will do everything possible to assist them at various points in the Orient, for this orginazation of aerial entertainers has been busy since closing last season's work at the Los Angeles Speedway on Thanksgiving Day overhauling and building equipment while rehearsing new features that promise to startle the natives of the Orient.

The roster of the company making the trip to the Orient, Australia and South Africa is as follows: Lois Barr and "Babe" Barr, lady pilot and aerial acrobat. Lois Barr will handle the "ship" while "Babe" walks the wings, loops the loop standing on top of the "ship" and changes to the plane flying above. Stunt pilots are "Jack" Schmitt, well-known overseas flyer; Lieut. Hugh Watson, formerly instructor of acrobatics at Taylor Field; Sergeant Peter Maraschi, formerly instructor in the Royal Italian Air Service, together with "Stub" Campbell, who will produce some new features in addition to ordinary wing-walking, plane-changing without rope or ladder and parachute jumping. Burt Barr, assisted by the Misses Billie and Inez Barr, will manage the show, while "Shorty" Filar will keep the motors humming.

New Activities of School of Aeronautics

It is a common experience that the theoretical knowledge gained in taking a course in aeronautics creates the desire to supplement that knowledge with actual flying instructions. In response to the demand of its students for flying lessons, the New York School of Aeronautics has organized its own flying school and will start its instruction work in that field this month at their Long Island flying field.

The plans include passenger flights, aerial phtography, aerial advertising and other activities in this field. This step is only one of the many progressive activities that the school is contemplating.

The present work of the school now covers the following courses: Aerodynamics, Aeroplane Drafting, Aeroplane Design, Motor Dynamics, Motor Design, and Primary and Advanced Flying.

Properties of Ordinary Wood Compared With Plywood

Wood, as is well known, is a non-homogeneous material, with widely different properties in the various directions relative to the grain. This difference must be recognized in all wood construction, and the size and form of parts and placement of wood should be such as to utilize to the best advantage the difference in properties along and across the grain. Were wood a homogeneous material such as cast iron, having the same strength properties in all directions that it has parallel to the grain, it would be unexcelled for all structural parts where strength with small weight is desired.

The Forest Products Laboratory has found that the tensile strength of wood may be 20 times as high parallel to the grain as perpendicular to the grain, and its modulus of elasticity from 15 to 20 times as high. In the case of shear the strength is reversed, the shearing strength perpendicular to the grain being much greater than parallel to the grain. The low parallel-to-the-grain shearing strength makes the utilization of the tensile strength of wood along the grain difficult, since failure will usually occur through shear at the fastening before the maximum tensile strength of the member is reached.

The large shrinkage of wood across the grain with changing moisture content may introduce distortions in a board that decrease its uses where a broad, flat surface is desired. The shrinkage from the green to the oven-dry condition across the grain for a flat-sawed board is about 8 per cent and for quarter-sawed board about 4½ per cent, while the shrinkage parallel to the grain is practically negligible for most species.

It is not always possible to proportion a solid plank so as to develop the necessary strength in every direction and at the same time utilize the full strength of the wood in all directions of the grain. In such cases it is the purpose of plywood to meet this deficiency by cross banding, which results in a redistribution of the material.

In building up plywood a step is made in obtaining equality of properties in two directions, parallel and perpendicular to the edge of a board. The greater the number of plies used for a given panel thickness, the more homogeneous in properties is the finished panel. Broadly speaking, what is gained in one direction is lost in the other. For a very large number of plies it may be assumed that the tensile strength in two directions is the same and that it is equal to the average of the parallel-to-the-grain and perpendicular-to-the grain values of an ordinary board. (*Technical Note from Forest Products Laboratory.*)

Olympian Airways Organizing Routes

The Olympian Airways, with headquarters in Minneapolis, are organizing an extensive system of aerial highways throughout the northwest for commercial purposes, linking Chicago, Minneapolis, St. Paul, Winnipeg, Omaha, and other cities to the south and west, including Denver, St. Louis, Kansas City, Memphis and New Orleans. It is the present plan of the company to operate Handley Page machines.

The routes have been selected after a careful study of conditions and intensive investigation. The interest evidenced all the way is very gratifying. Most cities readily recognize the benefits to be derived from aerial services and a hearty spirit of cooperation to the fullest extent is promised by Commercial Clubs and other Civic bodies.

Action on Riis Park Grant is Postponed

The Commissioners of the Sinking Fund postponed action for three months upon the request of the Navy Department for a grant of a portion of Jacob Riis Park at Rockaway Point for the establishment of a permanent air station.

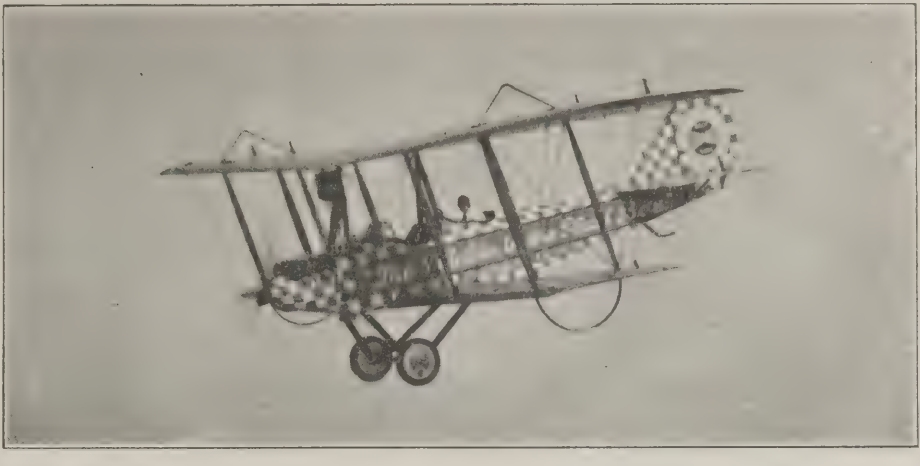
The Comptroller submitted a report in which he opposed "donation of this property to the Federal Government or its abandonment as a public park." The realty associates who sold the property to the city several years ago for $1,300,000 have offered to take the property off the city's hands at the same figure. The Comptroller urged that the Commissioners settle once and for all whether there is to be any abandonment of the tract for park purposes, and, if so, to accept the offer of repurchase of the land.

New Command at Camp Borden

Wing Commander J. Scott Williams is in command of the Canadian Air Force training operations at Camp Borden, succeeding Lieut.-Col. Douglas Joy. The regular transport service by aeroplane between the camp and Toronto has been carried out daily, officers of the force being able to make the 90-mile flight from the camp to the city in little over an hour. Some six hundred persons are now quartered at the camp, which is now the chief centre of aviation activity in Canada.

AERIAL ADVERTISING FROM MAINE TO FLORIDA

By HARRY D. COPLAND



THE following story concerning an aerial advertising flight which I made recently will, I am sure, be of interest to the many readers of AERIAL AGE who are utilizing machines commercially.

The plane which I used was an Aeromarine 39-B seaplane equipped with a Curtiss OXX-6 motor, purchased from the Navy in May, 1920, by Mr. P. H. Spencer, of Hartford, Conn. The machine was new, never having been removed from the packing cases by the Navy.

From the middle of May to June 15th this plane was flown by five different pilots on the Connecticut River at Hartford. I then became the pilot and carried passengers at Hartford until July 1st, when I flew the machine to Indian Neck, Conn., our base during the summer months. Flying from this base and nearby beaches I carried over 500 passengers during July, August and September. I then flew the machine to Hartford, where a landing gear was fitted in place of the pontoons.

Operating from a field three miles due north of the city hall at Hartford from October 4th to November 19th many passengers were carried.

A contract was then drawn up with the American Saw & Manufacturing Company, of Springfield, Mass., to advertise their Lenox Hack Saws by aeroplane, and the plane was painted as in the photographs, the colors being used were red, white and blue. The whole machine was then Valspared. This contract called for a flight from Portland, Me., to Daytona, Fla., with stops at the principal cities en route.

On November 19th I started for Portland with P. H. Spencer as passenger. Several officials of the Hartford Aero Club were on the field this cold, gray morning to give us a send-off. Framingham, Mass., a distance of 110 miles, was reached in 80 minutes. Good Army field here. Few good fields along route. Visibility was very low, consequently was forced to fly low over the B. & A. tracks from Springfield.

Was forced to remain in Framingham until November 27th by violent northeast gales and snowstorms. Machine was in the open and several mornings the snow had to be shoveled from the wings. Flew to the coast just north of Boston and followed the shore line to Old Orchard Beach, Me., covering the distance of 120 miles in 80 minutes. Old Orchard Beach makes an excellent landing place at low tide.

On December 3rd I flew over Portland with the American Saw & Manufacturing Company's dealer as passenger and threw out circulars. I then landed at Old Orchard and picked up Mr. Spencer and we headed south.

Dealers were carried and circulars dropped over the cities along the route. Boston was worked from Framingham and Philadelphia from Bustleton.

The trip continued as follows, bad weather being responsible for most of the long stops:

Portland to Boston, 120 miles 100 minutes. Over very poor flying country. Ground covered with snow. Good field at Framingham, 20 miles west of Boston.

Boston to Springfield, December 7th. 85 miles. 100 minutes. Over poor flying country. Finished this hop in heavy snowstorm. Landed good field three miles south of Springfield.

Springfield to Hartford, December 12th. Many good fields along Connecticut River; 25 miles 20 minutes. Landed good field three miles north of Hartford. A few days later this field was partly flooded by a rise in the river.

Hartford to Mineola, N. Y., December 19th; 100 miles 105 minutes. Plenty of fair fields. Ran into fog while crossing Long Island Sound; found Hazlehurst Field with difficulty due to this.

Mineola, N. Y., to Bustleton, Pa. (Philadelphia); 100 miles 90 minutes. Many good fields along route, except first 20 miles over thickly populated sections. Landed Air Mail Field. Good. December 20th.

Bustleton, Pa., to Aberdeen, Md.; 75 miles 85 minutes. Landed good field (Army) at Proving Grounds. Had planned to reach Baltimore, but ran into snowstorm December 26th. Many excellent fields along course.

Aberdeen, Md., to College Park, Md. (Washington); 65 miles 85 minutes. Very low visibility. Dropped circulars over Baltimore. Plenty of fields to Baltimore, few good ones beyond. Landed Air Mail field, fair.

Harry D. Copland

College Park, Md., to Richmond, Va.; 120 miles 100 minutes, December 31st. Good fields scarce along route. Landed fair grounds, center of race course. Very good. Very misty along Potomac River.

Richmond, Va., to Raleigh, N. C., January 6th, 1921; 150 miles 135 minutes. Few fields where one might land, but doubt if take-off would be possible. Landed in marked field two miles east of city, on slope and one way, poor.

Raleigh, N. C., to Fayetteville, N. C., January 11th; 65 miles 65 minutes. Ran into rainstorm. Country very poor to within 15 miles north of Fayetteville. Landed Pope Field (Army), 12 miles northwest of town. Very good.

Fayetteville, N. C., to Florence, S. C., January 17th; 100 miles 70 minutes. No good fields along route. After circling Florence for 25 minutes searching for a field was forced to land in very small plowed patch.

Florence, S. C., to Charleston, S. C., January 18th; 100 miles 90 minutes. Route mostly over swamps; no fields. Had heard that landing could be made in Hampton Park. Found building under construction here, so landed in plowed field. Got out of this field two days later in gale by lightening plane, and flew to field which Aviator Stewart Chadwick, his manager, mechanic, Mr. Spencer and myself prepared by cutting trees and brush and filling in ditches.

Charleston, S. C., to Savannah, Ga., January 24th; 90 miles 75 minutes. Route over swamps and thickly wooded section; no fields. Landed excellent municipal field at Savannah. City should be commended as being thoroughly up to date.

Savannah, Ga., to Jacksonville, Fla., January 28th; 130 miles 100 minutes. Route Savannah to coast no fields, then along beach good all the way to Fernandina at low tide. Fernandina to Jacksonville swamps; no chance to land without crashing. Landed Fair Grounds at Jacksonville; poor.

Jacksonville, Fla., to Daytona Beach, Fla., February 6th; 95 miles 75 minutes. Route Jacksonville to coast, poor. Beach good all the way from Pablo down. Ran into fog south of St. Augustine and landed on beach and waited an hour for fog to lift. Was alone on this hop, having left Mr. Spencer in Jacksonville. He followed by train. Landed Daytona Beach, Fla.; perfect field at low tide.

The total mileage and flying time, including trip from Hartford to Portland, is 1,660 miles in 24 hours 20 minutes flying time.

The total mileage and time for the Maine to Florida flight (the first to be made, I believe), Portland to Jacksonville, 1,335 miles in 20 hours 25 minutes flying time.

AVIATORS TO BOMB EX-GERMAN WARSHIPS IN TESTS

Washington.—A program for what promises to be the greatest naval and aerial gun and bombing test ever conducted has been approved for determining the relative effects of gun and bomb hits on certain types of war vessels.

In these joint army and navy tests which are to be made at sea between June 1 and July 15 next the obsolete American battleships *Iowa* and *Kentucky* and nine former German war vessels, allocated to the United States, will be used as targets. It is not the intention to sink the *Iowa* and the *Kentucky*. Dummy bombs will be used by the aeroplanes attacking these warships. All of the former German vessels, however, will be sent to the bottom.

The former German vessels are the dreadnought *Ostfriesland* and the light cruiser *Frankfort*, now in New York Harbor; three German destroyers now at Norfolk, and four German submarines, one of which, the U-111, is at Portsmouth, N. H., while the other three, the U-117, the U-140 and the UB-148 are at Philadelphia. Under a decision reached by the Council of Ambassadors, the destruction of the former warships is called for between May 1 and August 9 next.

Joint Board Agrees on Test

Announcement of the Government's plans for the tests was made by Secretary Daniels after he had approved recommendations made by the Joint Army and Navy Board, and sent the necessary instructions to Admiral Henry Braid Wilson, Commander in Chief of the Atlantic Fleet.

The board met to reach an agreement relative to the experiments. The members on behalf of the army are Major Gen. Peyton C. March, Chief of Staff; Major Gen. William G. Haan, Director of Army Operations Division, and Brig. Gen. Henry Jervey, Director of War Plans Division of the General Staff. The navy's members are Admiral R. E. Coontz, Chief of Naval Operations; Rear Admiral J. H. Oliver, Director of Naval Plans Division, and Captain Benjamin F. Hutchison, Assistant Chief of Naval Operations. The army will be represented by aeroplanes and the navy by destroyers and a dreadnought.

There is pending before the Senate Naval Committee a resolution directing the Secretary of the Navy to turn over certain obsolete craft to the Air Service of the army, and directing the Chief of the Army Air Service to conduct tests in study and development of aerial attack on warships. Senator Page, as chairman of the Senate Naval Committee, has requested Secretary Daniels to report on the wisdom of passing such a resolution. Secretary Daniels wrote to Senator Page telling him what has been agreed on between the army and navy for the coming tests. In view of these, the Secretary wrote, the passage of the pending Senate resolution is considered unnecessary.

The battleship *Iowa* will be radio-controlled during the tests. She will be attacked with dummy bombs by aircraft, from a minimum altitude of 4,000 feet, at a point within a zone between fifty and one hundred miles off coast between Capes Hatteras and Henlopen. The *Iowa* will try to avoid being struck by the bombs.

All Ex-German Ships to Be Sunk

The Ordnance Department has been ordered to prepare 298 bombs for use in the attack on the former German ships. The bombs used will weigh 230, 250, 520, 550 and 1,000 pounds or even more. One submarine is to be attacked and, if possible, sunk by bombs dropped from aircraft, while the other submarine will be subjected to shell fire from destroyers. If none is sunk by bombs they are to be destroyed by depth charges.

One of the three former German destroyers will be attacked by aircraft and the two others by destroyers. If aircraft and destroyers fail to sink them they are to be attacked by battleships, and afterward, if still afloat, are to be sunk by depth bombs. The first attack on the *Frankfort* will be by aircraft using 250-pound bombs; the second by aircraft using 520-pound bombs. After the army aircraft have their innings the cruiser, if afloat, will be examined and then will be subjected to gun fire from a division of American destroyers at 5,000 yards range. If both gun and bombing attacks fail the *Frankfort* is to be sunk by depth charges.

The most spectacular attack will be directed against the *Ostfriesland*. The army aviators will attack her with 550 and 1,000 pounds, or heavier bombs, either singly or in groups. Each attack will be followed by an examination of the battleship, if she is still afloat. Should the aircraft fail, the *Ostfriesland* will be shelled by an American dreadnought, firing 14-inch shells at a range of not less than 18,000 yards. Then, if the *Ostfriesland* still floats, she is to be sunk by depth bombs.

The ships are not to use machine guns, gas or incendiary or smoke bombs in defense.

The recommendations submitted to Secretary Daniels by Admiral Coontz, as senior member of the joint board, and approved, were in part:

Objects Sought in Tests

"That the bombing experiments contained in the exercises to be conducted by the navy are designed to determine:

"1. The ability of aircraft to locate vessels operating in the coastal zone and to concentrate on such vessels sufficient bombing aeroplanes to make an effective attack.

"2. The probability of hitting with bombs from aeroplanes a vessel under way and capable of manoeuvring, but incapable of anti-aircraft defense.

"3. The damage to vessels of comparatively recent design which will result from hits from bombs of various types and weights."

No report of conclusions as to the probable damage to personnel or equipment or probable or actual damage to the watertight integrity of the target vessel or vessels in general is to be made except by a board in which the navy shall have representation. The results of the experiments and the conclusions drawn are to be held secret by the War and Navy Departments until passed on by the joint board.

Secretary Daniels's Orders

In his instructions to Admiral Wilson Secretary Daniels said:

"In preparing this order the department has been guided by the following considerations:

"Successful naval warfare insures freedom of movement of our own merchant vessels and transports and denies freedom of movement to enemy vessels. Modern fleets will be accompanied by aircraft and vessels will be armed with anti-aircraft batteries. Operations against naval units operating in the coastal zone, from the point of view of the effectiveness of aircraft, divide logically into three phases—the location of such naval units, the ability of the aircraft to hit vessels with their projectiles, the ability of the projectiles seriously to damage a vessel."

"Savoia" Hydroplanes

A brief description is given in this article of the various types of "Savoia" machines, which have made a name for themselves both during the war and since the signing of the armistice. It will be remembered that a Savoia S-12 won the Jacques Schneider Cup last year. A new machine the S-16 has been constructed and the main characteristics of these two types are compared.

	Type S-12	Type S-16
Length	11 m 50	10 m 01
Span (top plane)	15 m 07	14 m 89
(Bottom plane)	13 m 76	14 m 868
Height	3 m 80	13 m 60
	Ansaldo	Fiat
Engine	450 H.P.	280 H.P.
Weight—empty	1,600 Kg.	1,300 Kg.
Loaded	2,400 Kg.	2,100 Kg.
Passengers	4	5
Speed	215 Km.	170 Km.
At 2,000	205 Km.	165 Km.
Duration	4 hrs.	4 hrs.

Wibault Machines

In this article the general characteristics are given of three types of military Wibault machines which have been ordered by the French government.

Aeroplane W. I. B. I C I, 1918 *type, biplane scout:*

220 HP Hispano Suiza engine.

Armament: 2 Vickers guns, & 1.000 cartridges.

Span: 7 m. 800. Length: 6 m. 300.

Surface: Sq. metres 21,850.

Weight, in running order: 896 kgs 500.

Speed, with complete military load: 257 kms/hour.

Ceiling: 7.000 metres.

Aeroplane W. I. B., 2 BN 2, 1921 *type, bombing biplane*:

This machine is the most powerful French single-engined biplane, and is entirely made of metal.

600 HP Renault engine.

Span: 16 m. 900.

Length: 12 m. 750.

Useful load: 2.300 kilogrammes.

Speed at 2.000 metres: 200 kms/hour.

Ceiling: 5.000 metres.

The same type of machine has been manufactured, and can carry 12 passengers, in a very comfortable cabin, 4 m. 50 long, 1 m. 60 wide and 1 m. 80 high.

Aeroplane W. I. B. 3 C 1, 1921 *type, single seater Scout, for High altitudes.*

Monoplane, all metal construction.

300 HP Hispano Suiza engine, turbo-compressor Rateau.

Span: 11 m. 400.

Length: 8m. 050.

Useful load: 450 kilogrammes.

Sped at 5.000 metres: 300 kms/hour.

Ceiling: 12.000 metres.

The same type of machine has been designed for carrying 150 kilogrammes of postal load, with a range of action of 1.000 kilometres.

Speed: 300 Kilometres/hour.

(*"L'Air" French Aircraft Review,* 1921.)

LOADS AND CALCULATIONS OF ARMY AEROPLANES*

By ING. STELMACHOWSKI

(Translated from Technische Berichte by Office of Naval Intelligence, U. S. N.)

A MILITARY aeroplane must fulfill two conditions:

1. It must be aerodynamically capable of good performance.
2. It must also be structurally strong enough to maneuver without risk of failure.

It may seem superfluous to note, yet it cannot be overemphasized, that an aeroplane of good flying qualities is useless if it is not sufficiently strong and fails at the critical moment. A justified lack of confidence on the part of the pilot in the strength of his aeroplane will prevent him from taking complete advantage of its possible merits. Therefore, a constructor should not be criticized for carefully investigating the strength characteristics of his designs.

What, then, must be the requirements for strength so that a pilot will have at his disposal a powerful but not too heavy aeroplane. The answer depends on the magnitude of the air forces or accelerations to which the moving aeroplane is subjected. Investigations of these forces have not been carried far enough so that they can always be estimated, and, where there is apparently a clear understanding of the effect of the air forces, mathematical methods for expressing these effects in useful form are lacking. It is not even possible to cover all possible cases by full flight investigations of these phenomena, since such maneuvers as an aeroplane pilot ventures or instinctively carries out in moments of great danger cannot be imitated intentionally. It is in just such cases that the machine is subjected to the most dangerous loads.

Because of these difficulties it is useful and necessary to be governed by experience. That is, if one aeroplane of known strength has resisted all the usual and even the extreme air loads to which it can be subjected, and if a second aeroplane having less strength than the first was found, under like conditions to be insufficiently strong, it is obvious that the strength required is greater than that of the second aeroplane but not greater than that of the first. If, as is now actually the case, strength factors of different aeroplanes of the same class do not differ to any great extent, then the permissible values are fairly well defined.

On the basis of such experience, aided by scientific investigations, standards have been developed which are satisfactory for the calculation of aeroplane structures.

I. Loads on the Wing Truss

Loads on the wing truss are expressed as multiples of the weight of the aeroplane, the air forces which keep the aeroplane in equilibrium being proportional to its weight. If, furthermore, the admissible and simplifying assumption is made that the air forces which counteract the forces of acceleration on the wings of the moving aeroplane are equally distributed along the wings, then the air forces on the wings may be considered as being proportional to the quantity: *Total weight minus weight of wings.*

Hence the weight of the wings themselves is not to be included when calculating the stresses in the wing truss. The wings are supported by the sustaining air pressure; and that portion of the air forces that balances the forces of acceleration on the wings, being equal and opposite and acting at the same points, cannot give rise to any moments in the structure.

The numbers by which the quantity *Total weight—weight of wings* are to be multiplied in order to obtain the applied load are called "Load Factors." These vary according to the conditions of flight and have, for convenience, been grouped under four representative conditions or "load cases."

1. Case A—Taking-off (or large angle of incidence).
2. Case B—Gliding at 30° to the horizontal.
3. Case C—Nearly vertical dive.
4. Case D—Upside down flying.

However, it would not be justifiable to use the same load factors for all types of aeroplanes, even under the same flight conditions. As already stated, the air forces on the wings correspond to the acceleration forces on the moving aeroplane. Since the acceleration forces depend on the rate of change of velocity, they are therefore greater the more rapid and maneuverable an aeroplane is. Since usually the speed and maneuvering ability depend on the weight or useful load, it is evident that types of aeroplanes can be divided according to weight or effective load into different "calculation groups." According to present practice, aeroplanes may be divided into five such groups:

Calculation Group I. Aeroplanes of any type of construction having a flying weight greater than five tons, *i. e.,* giant planes that are required to cover great distances with the maximum possible useful load, abundant fuel and bombs, but without great speed.

Calculation Group II. Aeroplanes of two and one-half to five tons flying weight and one to two tons useful load; this includes small and short-range bombers.

Calculation Group III. Aeroplanes of two and one-half to four tons flying weight and 1,700 to 3,300 lbs. useful load. This includes those larger flying machines which are distinguished from those of Groups I and II by greater fighting value and consequently greater speed and mobility.

Calculation Group IV. Aeroplanes of 2,600 to 5,500 lbs. flying weight and 900 to 1,800 lbs. useful load. These include two-seaters for photographic, reconnaissance, battle and scouting purposes.

Calculation Group V. All aeroplanes of less than 2,600 lbs. (up to 900 lbs. useful load), hence single-seaters and light two-seaters of any kind.

Of course no such division into classes can be correct in all details if it is intended to be general. In order that the classification be pliable and afford room for new types it has been decided that the Imperial Aeroplane Department be authorized to decide in which group a new type should be placed.

The load factors required can thus be originally determined from the flight conditions and calculation groups. The accuracy of calculated factors depends on the exactness with which the distribution of loads among the structural members can be determined.

It is obvious that stress analysis may be avoided and the strength of the finished aeroplane demonstrated by sand loading. This was customary in the early days of aeroplane construction; new types were developed by trial, the machine was completely built and subjected to the sand load. This method no longer suffices, for unavoidable errors in construction caused great losses in time, labor and raw materials. Today science gives the constructor means to calculate the required dimensions of the structural members from the beginning of the design. Furthermore, today it also furnishes methods by which the best form and most suitable construction consistent with least weight may be determined. In spite of this progress it is not possible, owing to the lack of trained workers and dependable structural materials, to entirely do away with sand loading.

Although the strength of a flying machine may have been carefully calculated, it should still be required that its structural strength be demonstrated by a sand load.

The mathematical calculations of the strength of individual members of the wing truss do not exactly coincide with the results of the actual load tests. In the mathematical analysis the truss is considered as a structure built of separate and individually considered members. Actually, however, the wings do not act as mere jointed frameworks of spars and compression struts, but, because of the added stiffness of ribs and fabric, act somewhat like separate rigid bodies.

In the case of test-loading these influences have an effect whereas in calculation they are neglected. Accordingly two requirements must be satisfied under conditions A, B and D, one for purposes of calculation, using low load factors, and the other for sand testing with high load factors. In case C a double requirement is not necessary for a high head resistance is indicated even by calculation and because the relative stiffness of the wings is smaller in proportion to the torsional moment while diving.

Tables I and II give the load factors compiled according to the above considerations, for stress analysis and for sand testing. The loads specified are breaking loads; *i. e.,* under these loads the members should be stressed nearly to their ultimate strength. This does not mean that the air forces encountered are actually as great as the sand loads specified. These factors include a certain factor of safety to allow for the nature of the load and for the characteristics of the structural materials.

The following effects have been considered in this connection:

* Checked by D. L. Bacon, Assistant Physicist, Aeronautical Laboratory, N. A. C. A.

TABLE I. LOAD FACTORS FOR USE IN STRESS ANALYSIS

Group No.	Type		Case A	Case B	Case C	Case D
	Flying Weight Lbs.	Useful Load Lbs.	Take-off	Gliding	Diving*	Upside down
I	Over 11,000		3.5	2.5	1.2	.....
II	5,500–11,000	2,200–4,000	4.0	2.5	1.5	....
III	5,500– 9,000	1,800–3,300	4.5	3.0	1.75	2.5
IV	2,500– 5,500	900–1,800	4.5	3.0	2.0	2.5
V	Less than 2,500	Less than 900	5.0	3.5	2.0	3.0

TABLE II. LOAD FACTORS REQUIRED IN SAND TESTING

Group No.	Type		Case A	Case B	Case C	Case D
	Flying Weight Lbs.	Useful Load Lbs.	Take-off	Gliding	Diving	Upside down
I	Over 11,000		4.0	2.5	1.2	....
II	5,500–11,000	2,200–4,400	4.8	2.6	1.5	....
III	5,500– 9,000	1,800–3,300	5.5	3.2	1.75	2.8
IV	2,500– 5,500	900–1,800	5.7	3.3	2.0	2.8
V	Less than 2,500	Less than 900	6.5	4.0	2.0	3.5

*The factors for Case C apply to drag forces but not to diving moments.

1. The loading during flight is not constant but changes suddenly in such a manner that the strength characteristics of the materials, especially their stiffness, cannot be fully developed. This includes both suddenly changing air loads and the effect of motor vibrations.

2. Some members are unduly stressed due to high and indeterminate initial tensions in the stays.

3. Wooden members, such as spars, ribs and struts deteriorate through the action of time and weather.

4. Experience shows that aeroplanes in quantity production generally are somewhat heavier than the original model machine, due to subsequent changes and additions.

The foregoing affords a basis for the statement that the values given in the table are for ultimate static loads. It would therefore be incorrect to assume a factor of safety when any structural member appears to be loaded in excess of the safe limit of the material.

The increases in magnitude of the load factors in Table II over those in Table I are the result of experience. A comparison between calculated strength and actual breaking strengths has shown no differences amounting to as much as 30 per cent. These differences, however, decrease as the size of aeroplane increases, and a corresponding allowance has been made in the tables.

It seems superfluous to discuss in detail the prescribed loads indicated in Fig. 1.

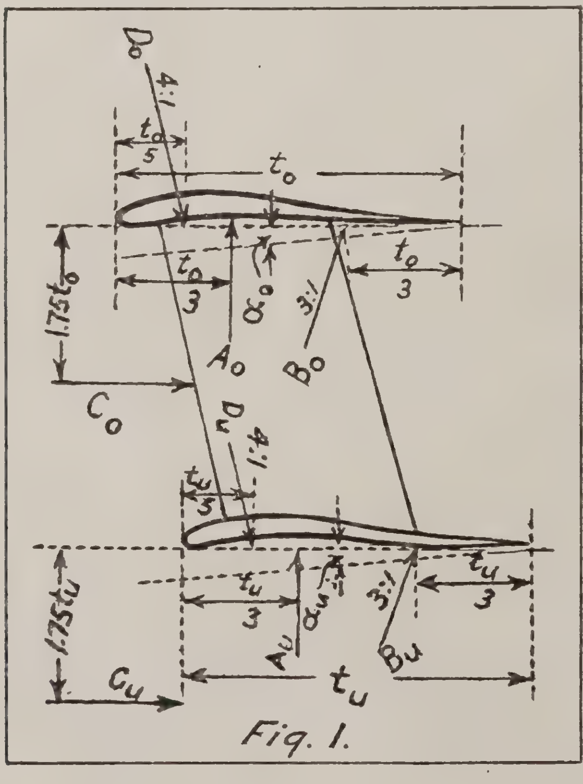


Fig. 1.

As long as no new developments prove the insufficiency of these assumed loads we may consider them to represent the facts. An explanation is needed, however, for the increase in the diving moments in Case C (vertical dive). During a dive the air force act so that the front part of the wing experiences a pressure from above and the after part a pressure from below. Thus a couple is set up, producing a moment about an axis parallel to the spars. According to recent tests in the Göttingen wind tunnel and according to theoretical aerodynamic investigations, the moments formerly assumed have been too small. If the moment about a wing be expressed by

Constant x Chord x (Drag Load) where

Drag on upper wing + Drag on lower wing = Total weight — weight of wings,

then the constant must be so chosen that when multiplied by the chord it will give the proper moment arm.

From a number of experiments the following average values were found:

$$M \text{ lower wing} = 1.75\ R^{x}_{\text{lower}} \text{ chord, instead of } \frac{2}{3} R^{x}_{\text{lower}} \text{ chord.}$$

$$M \text{ lower wing} = 1.75\ R^{x}_{\text{lower}} \text{ chord, instead of } \frac{2}{3} R^{x}_{\text{lower}} \text{ chord.}$$

Experience shows that we have enough measurements with the hitherto existing moments and load factors—except for internal stresses in the lower wing—so that we would not be justified in increasing the lever arm two and a half times to increase the moments proportionately.

Returning, then, to known moments, load factors for the moments in Case C are omitted. In order, however, that too small internal stresses shall not be obtained, the partial forces acting as drag on the wing surfaces are multiplied by the corresponding load factors.

This requirement is not contradictory. It takes account of the fact that the spars must be strong enough to suit other loading conditions, while the internal stresses should be particularly investigated for diving conditions. It should also be realized that in diving a large portion of the air force is taken up upon the body and its appendages, which is not taken into account of either in the calculations or in sand testing, thus, after experience with the old requirements, the new ones must also suffice to guard against insufficient dimensions.

Proportions of the Load Assumed by Upper and Lower Wings. Lacking more complete information on the subject, all aeroplanes are calculated on the basis of a 11 : 9 ratio of load distribution between upper and lower wings. Although this is doubtless a good average value, it is not to be overlooked that a closer approximation to actual values would be desirable. The division of load between upper and lower wings depends on both gap and stagger. Accordingly diagrams are given in the 1918 edition *Neuauflage der Bau—und Liefervorschriften* showing this relation in terms of gap and stagger. In Case C (vertical dive) the division of load is independent of stagger.

Distribution of Air Forces Along the Span. We have hitherto assumed the air pressure to be evenly distributed along the wing span. This is not entirely correct, as the pressure diminishes near the wing tips and within the area of slip stream. For purposes of calculation the pressure per unit length a is assumed to decrease from P at a point one chord length distant from the wing tip to $\frac{P}{2}$ at the extreme tip. For calculating the span itself the full pressurt P is assumed to extend to the wing tip.

Unsymmetrical Loading. All previous considerations have reference to a load symmetrically distributed on both sides of the central axis. In curved flight, however, the load is no longer symmetrical. Nevertheless, no special load case has been introduced for unsymmetrical loads because the cabane and the body longerons supporting it are the only parts unusually stressed.

II. Loads on Control Surfaces

In determining the loads on control surfaces the same difficulties are encountered as with the main supporting surfaces. As far as the control surfaces themselves are concerned, the loading is unimportant, as they are so small that a high factor might easily be obtained with negligible increase in weight. The control surface loadings are important, however, in proportioning the members of the body which support them. Because of its rigid construction the body is usually to be considered as a single unit, and changes in the position of the cen-

ter of pressure on the tail cause only a slight variation in the moments, on the body, so that only the magnitude of these forces is of importance. The task is thus essentially simplified, it only remains to discover what are the maximum possible loads on the tail surfaces.

The tail surface load may be expressed by

$$q = \mu \cdot \frac{\gamma . V^2 max}{2g}$$

and is principally influenced by the speed and the constant. The maximum speeds for any type of machine are known approximately or are specified. The maximum value of q depends on the angle of incidence of the fin and the displacement of the rudder. As these are limited by the construction of the machine it will suffice to consider the least favorable case. The Research Laboratory at Göttingen has carried out a great many investigations of control surfaces* which have furnished reliable data for calculation. The following loads are specified for the various type classifications, which furnish a basis of comparison regardless of speed.

TABLE III. SPECIFIED TAIL PLANE LOADS

Group Number	I	II	III	IV	V
Average Load lbs. / sq.ft.	24.6	24.6	30.7	36.9	41
Average Load, Kg/m2	120	120	150	180	200

The values given in this table agree closely with recent practice. Because of possible damage to surfaces during shipment and handling, fins on aeroplanes of Group I are calculated on a basis of 200 Kg/m² and of Groups II to V inclusive, on a basis of 300 Kg/m². Rudders are likewise calculated at 200 Kg/m². Experience has shown that rudders so designed are sufficiently stiff and strong.

III. Loads on Wing Ribs

The nature of rib loads has been previously considered in *Technische Berichte*, Vol. I, No. 3, p. 81. The same load factors are used as for the wing truss in Cases A, B and D. In Case C the moment specified for the truss should be increased 50 per cent. The strength of wing ribs must always be demonstrated by trial loading for, because of the minute dimensions of the component parts, mere calculation is insufficient.

IV. Loads on Landing Gear

Three conditions of loading are to be considered (see Fig. 2). A load directly under one wheel (force A), a retarding force (force B) and a side load (force C).

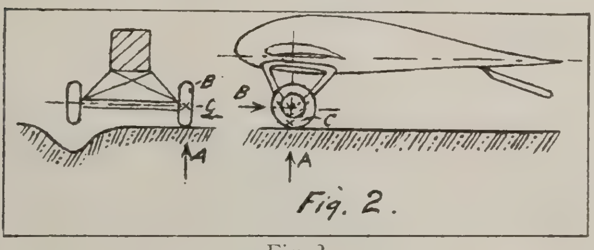


Fig. 2.

Forces A and B or A and C act simultaneously and amount at least to the following multiples of the static loads per wheel (one-half total weight for two-wheeled aeroplanes).

Force	*Multiple*
A	6
B	4
C	0.6

V. Calculation

Static investigations are carried out according to established methods. For load distribution between members of the wing truss it is immaterial what loading is used, for the stresses are proportional to the load and can subsequently be found for any load factor. In contrast to this are the fiber stresses in members, such as wing beams, under compression and bending loads where the stresses are not directly proportional to the load factor but to an exponential function thereof.

For what load factor should the calculations then be carried out? The static analysis would be most exact under loads which do not stress the members above their elastic limits. This procedure is, however, subject to objections.

1. For wood, the most common structural material, the elastic limit is difficult or impossible to define, and varies so much under different conditions that it does not furnish a good basis for calculation. The ultimate strength, however, for any cross section and type of loading may be determined with sufficient accuracy.

2. As already stated, the specified load factors do not represent the actually experienced air loads but also include effects of vibration, deterioration of material, etc.. It is important, however, that the constructor know the behavior of the members under breaking load. As no simple relation between load and strain exists, he would be unable to tell, when calculating with light loads, whether the deflections for ultimate load exceeded the limits of safety.

Therefore, if it is not practicable to carry through calculations for several different load values, it is advisable to make the static analysis for the ultimate load.

In calculating wing spars the application of loads must be considered with especial care. Euler's formula does not apply to short struts and the strength of these should be found by experiment as Tetmajer's formula does not hold for struts of hollow section.

VI. Rigidity of Materials

The accuracy of static analysis depends on the use of correct values for the elasticity of the structural parts. For both wood and duralumin, the materials most used, the coefficients of elasticity and elastic limits are so dependent on the size and shape of the member that in some circumstances large errors would be introduced by the use of their average values. This is also true for steel cables. It is therefore essential that the elasticity be measured in each individual case on specimens which check exactly with the required dimensions, and which are subjected as nearly as possible to the desired load. The elastic curve of cables is therefore to be obtained by the use of actual lengths and cross sections, and with due regard to splices and thimbles, in at least three tests.

The determination of elasticity in spars under exact flight conditions, *i. e.*, under compression and bending loads, is not usually convenient because of the lack of time and of laboratory facilities. However, it is considered satisfactory to obtain the elasticity of a beam eccentrically loaded as shown in Fig. 3.

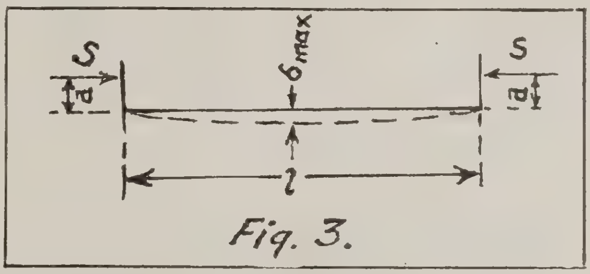


Fig. 3.

The length of the specimen must be equal to the distance between panel points on the wing, and the eccentricity *a* must be so chosen that the maximum bending moment produced will be equal to that on the actual spar.

In order to estimate the distance *a* a first approximation E' is assumed, and *a* is calculated from

$$\frac{S . a}{\operatorname{Cos} \frac{l}{2}\sqrt{\frac{S}{E' . J}}} = \text{Maximum bending load on spar.}$$

The test can then be carried out by gradually increasing S to the breaking load, measuring the deflection in the center S after each increase in load. The value of S_{max} immediately before rupture is of the greatest importance, therefore especial care is necessary at this point or the experiment will be worthless. Using S_{max}, the correct coefficient of elasticity E, for use in calculating breaking loads is obtained from

$$\operatorname{Cos} \frac{l}{2}\sqrt{\frac{S}{E . J}} = \frac{1}{1 + \frac{\delta_{max}}{a}}$$

* *Technische Berichte*, Vol. I, No. 5, p. 168.

FOREIGN TECHNICAL DIGEST

Static Tests of Aeroplanes

The importance of safety in commercial aviation is a measure of the necessity for testing. A review of various methods of loading aeroplane structures to ascertain their strength is given.

First, it is assumed that the aeroplane is under the action of three forces in horizontal flight:—

1. The weight of the machine and its load.
2. The reaction of the air on the machine.
3. The propeller thrust.

A description is given of the method adopted by "L'Institut Aerotechnique de St. Cyr" and the formulæ adopted to ascertain the test loads to be imposed. The aeroplane is turned upside down and supported on trestles. Loads of sand are placed upon the wings to represent the air pressure, and the deflection due to these loads measured by cords attached to dynamometers. Secondly, the stresses set up in an aeroplane structure when "stunt" flying is undertaken are considered. The forces acting on the machine during a nose dive, loop, spinning, etc., are analysed and methods of reproducing by means of sand bags described. Tests for lateral flexion and torsion of the fuselage are made by progressive loading on each wing and on the tail planes, and testing the undercarriage is carried out with the tail inclined to the ground at 25°.

The method adopted by the British A.I.D. is briefly referred to. (*L'Aeronautique*, Oct. 31, 1920.)

Isotta Fraschini Motors

The 160 h.p. engine is of the 6 cylinders in line type. Cylinders are cast in pairs. The spherical combustion chamber and the valve ports are well designed. The valves, which are operated by an overhead camshaft, can be removed without disturbing the cylinders. Each pair of valves has a common spring placed between them and joined by a horizontal bridge.

The principal dimensions are:—Bore, 130 mm.; stroke, 180 mm.; volume per cyl., 2.389 c.c.; compression space, 583 c.c.; compression ratio, 5 to 1; maximum piston speed, 12m.63 per sec.; minimum piston speed, 7m.80 per sec.; diameter of valves (inlet and exhaust 2 per cylinder), 56.5 mm.; develops 150 h.p. at 800 r.p.m., 133 h.p. at 1,000 r.p.m., 177.5 h.p. at 1,300 r.p.m.

A more recent type is the V9 (150 by 180), giving 310 h.p. at 1,700 r.p.m., weighing 310 kg., with propeller boss. (*L'Aeronautique*, Oct. 31, 1920.)

Installation of an Aeroplane Engine

This paper by A. J. Rowledge was read before the Royal Aeronautical Society, London. It limits itself to a discussion upon the application of the title to one particular type of engine, viz.: the Napier "Lion" installed in several machines, the author claiming that he is able to vouch for the accuracy of the information and data relative to this engine.

Attention to detail is the keynote to successful engine installation, as small defects due to lack of this are always sufficient to prevent a perfectly good engine from functioning properly. The main causes of trouble in this respect are: (1) Failure of petrol supply; (2) failure of oil system; (3) failure of ignition; (4) overheating; (5) fire; (6) engine starting accidents.

Petrol System.—Assuming the usual system of a wind-driven pump delivering to a junction box with branches to the carburetter and the gravity tank, a cock must be fitted between the main tank and the junction box, to prevent air being pumped into the system when the tank is empty, and to isolate the gravity from the main tank. Also an overflow pipe, with a flow indicator, should take the excess petrol from the gravity to the main tank. Engine-driven pumps, pumps duplicated, and hand pumps to feed the gravity tank are recommended.

Oil System.—The oil tank should be part of the engine for flights up to 4 hours, and a reserve oil tank with one connecting pipe for longer flights fitted. Oil-cooling arrangements with thermometers and suitable filters should be added.

Ignition.—Two independent systems and two plugs in each cylinder ensure reliability and maximum power.

Overheating.—Sufficient cooling *must be* provided for the worst conditions and shutters fitted to reduce this as necessary. Smooth cylinders should be arranged as cooling surface when possible.

Fire.—Carburetter intakes outside, grouping of mixture pipes with separate carburetters, cooling and supporting of exhaust pipes to minimize chances of bursting, use of fireproof magnetos, and separating the tanks from the engine by a fireproof bulkhead are suggested as preventative measures.

Starting.—Engines should be capable of being started from the pilot's seat. Gas starters are of the most economical weight.

Various.—Other precautions suggested are that the throttle and mixture controls should be interconnected, and that all engine controls should be rods and levers instead of wires.

(*Aeronautics*, December 23, 1920.)

Some Problems in Aeronautical Research

This paper by Air Commodore H. R. M. Brooke-Popham, C.B., C.M.G., D.S.O., A.F.C., was read before the Cambridge University Aeronautical Society. Dealing with the importance of a reliable aero engine, the writer says:

"Of the accidents that have occurred to aircraft since the armistice, it is found that approximately half were caused primarily by what is commonly called "engine failure." From an analysis of these engine failures it is found that, where the cause can be definitely stated, 80 per cent. are due to what I term "engine accessories," and only 20 per cent. to the engine itself. The accessories include the petrol and water systems, the ignition system, including sparking plugs and any external lubrication system. Failures due to the engine itself are such things as broken connecting rods and leakage of water jackets. It is unnecessary to point out that reliability of the engine is of the utmost importance both for civil and for military aircraft, but it appears that it is the accessories to which we must devote our attention more than the engine itself. Take the petrol system. Most of these are, I think, unnecessarily complicated. There are not only an enormous number of pipes, but also a very large number of taps, which have to be controlled by the pilot, and it is by no means infrequent for a pilot to turn one of these taps on wrongly, and thus bring down a failure of the supply to the engine. Thus, one definite thing that is wanted is a simplified method of petrol feed."

The advantages of flying at high altitudes in order to utilize the prevailing wind currents are next dealt with and the problems connected with the corresponding loss in engine power are touched upon.

"The Germans, in some of their machines, fitted in an auxiliary engine driving a blower; in one type this auxiliary engine was 110 horse-power, the total power of the main engines being approximately one thousand. A German report states that by this arrangement the power of the main engines could be kept constant up to an altitude of 16,500 ft.

Another method is to have a blower driven off the main engines; and still another to fit in a turbine in the exhaust, also driving some form of blower.

The turbine blower is the most attractive, but the trouble here is to get a turbine that will stand up to the heat of the exhaust. We think we have got a satisfactory metal for the turbine blades now, but it hasn't been thoroughly tested out yet.

One doesn't really get much advantage from maintaining the power of an engine at high altitudes unless one has a variable pitch propeller as well. The reason for this is quite obvious.

We have not yet got a completely satisfactory variable pitch propeller.

With regard to new engine design, it is interesting to refer to two German developments.

The first is a two-stroke engine by Professor Junker in which he employs the principle of two opposed pistons working in one cylinder on to two crank-shafts. He employs rather a novel method of cooling the pistons—viz., to fill them partially with some liquid which dashes about inside the piston-head, the idea presumably being that the liquid will get cool on the circumference of the piston, and thus abstract heat from the head.

The second one is a design by a man named Holmann Hirth. It is also a two-stroke engine. He leads the engine exhause through the propeller and out near the propeller tips; his idea apparently being that the centrifugal force will cause a scavenging effect in the cylinder, and thus get over one of the principal difficulties of a two-stroke engine. This proposal doesn't seem attractive, but has the merit of originality."

(*Aeronautics*, February 3, 1921.)

Optical Principles of Illuminating Engineering

The paper deals with developments in applied optics affecting illuminating engineering, under the following heads: The conditions for best seeing; brightness and retinal flux density; the lower limit of vision; the upper limit of vision-glare; and normal vision. (P. G. Nutting, *Transactions of the Illuminating Engineering Society*, Nov. 20, 1920.)

NAVAL and MILITARY AERONAUTICS

Aircraft with the Fleets

The Atlantic and Pacific air forces are cruising northward along the East and West coasts of Mexico with gratifying success.

The airboats of the Pacific Fleet Air Forces have safely reached Punta Arenas, thus completing the second leg of their 3,200-mile flight.

The Atlantic Fleet Air Force, which had to pursue a roundabout cruise in order to miss the strong trade winds from the northeast, safely finished the fifth leg of their flight when they arrived at Belize. From here they will cruise northward until they strike a point on the Mexican coast directly west of Cuba, when they will fly directly west for Guantanamo Bay.

Bombing Training Course at Kelly Field

January 21, 1921, was the date that was set for the beginning of the Bombing Course for cadets assigned to the Bombardment Group. Teams composed of officers and cadets have been arranged for the performance of bombing practice flights. The Bombardment Group issues operations orders daily as to what teams are to report in this daily training practice. Cadets are to fly from 8:30 A. M. to 9:45 A. M. and from 10:15 A. M. to 11:30 A. M. Officers fly from 8:30 A. M. to 10:00 A. M.

Radio Activities at Kelly Field

The Wing Communications Officer of Kelly Field is erecting a vertical fan-shaped antenna, the highest part of which will extend 65 feet above the ground. The antenna will be suspended from two masts, each of which will be painted alternately black and white, and will be plainly marked with a large black ball at its upper extremity. These masts will be mounted, one on Building No. 45 and the other on Building No. 51. Flags will be suspended from the cross-wire at several points throughout its length, to warn all pilots and students from running across the wires while attempting to land.

Naval Airmen Warned

Boston.—"In view of recent incidents" American aircraft commanders are directed to avoid flights about foreign ports that might be regarded as for observation purposes, is an order received here from Rear Admiral R. E. Coontz, chief of naval operations. The order says:

"It is especially important that the local officials in foreign ports be advised in advance of prospective movements of our aircraft. In directing the course of aircraft in foreign territory pilots will be particular to avoid the suggestion that the flights are being made for the purpose of observing fortifications or other military or naval works."

It is understood that questions arising out of aeroplane operations during joint manoeuvres of the Atlantic and Pacific Fleets in Central American waters occasioned the warning.

The A. S. Border Patrol

Out along the Rio Grande where it cuts its way through barren mountain ranges and runs in deep canyons, where nothing but rocks and sand greet the eye for miles and miles and man seldom sets his feet, the "Border Patrol" watches over the vast and lonely territory of the Border Line to prevent any infringement upon the laws of the United States.

The patrol is composed of officers of the Air Service who fly along the border twice a week watching the international boundary for hostile bandits, the wary bootlegger or the wily ammunition runner. Over the unending mass of rocks and steep mountainsides the aviator sails, knowing that if ever his motor fails or his fuel runs out, somewhere on the sharp rocks below he must pilot the plane, only to go crashing into canyon or mountainside. The Air Service has every reason to be proud of these intrepid airmen.

Pursuit Training at Kelly Field

The entire class of Student Naval Officers assigned to the Pursuit Group for advanced training have been assigned to SE-5's. It is expected that these officers, who have had a great deal of time in seaplanes, will be very proficient in handling the pursuit type plane. During the past week cross-country formations and echelon formations have been the order of the day. A little target practice has been done and it is expected that this type of training will take up a large amount of time in the future. The 147th Aero Squadron is still safely in the lead as regards flying time, having piled up a total of 250 hours this month. On Thursday, January 27th, Major General Menoher, Chief of the Air Service, visited the field on an inspection tour and the group put on an impressive exhibition in his honor. A large 20-ship echelon formation was executed and made several circuits of the aerodrome. This was then formed into a gigantic Lufberry circle and, upon the breaking up of this, some picked pilots formed a flying circus and executed loops, rolls, half-rolls, etc., for the benefit of the General. Lieutenant Sheridan, of the 147th Squadron, made a remarkably long flight with the ship inverted so that it was upon its back. This is a difficult maneuver and was executed perfectly by Lieutenant Sheridan.

Report on Reserve Officers' Training Corps

February 1, 1921.

1. The Reserve Officers' Training Corps was first organized in 1916 and since then the various Arms of the Service have established units at important colleges and universities throughout the country. The Air Service, being the newest combatant Arm, was last to become established, for it was not until November of 1920 that the Air Service R. O. T. C. Units were organized.

2. A large number of leading colleges and universities of the country made application for the Air Service Units and the final recommendations were made with the following considerations in view:

(a) Success of other R. O. T. C. Units already established at these universities.

(b) General attitude of the institution.

(c) Experience with Schools of Military Aeronautics during the World War.

(d) Technical qualifications of institutions with particular reference to aeronautical engineering.

3. Six units are now established and operating successfully with an Air Service officer in charge of the unit.

Texas Agricultural and Mechanical College, College Station, Tex., Major C. W. Russell; Massachusetts Institute of Technology, Cambridge, Mass., Capt. Wm. B. Wright; Georgia School of Technology, Atlanta, Ga., Capt. L. E. Goodier, Jr.; University of Illinois, Urbana, Ill., Capt. John G. Whitesides; University of California, Berkeley, Cal., Major W. A. Robertson; University of Washington, Seattle, Wash., Major H. C. K. Muhlenberg.

These are the pioneer units to make the way for more units which will be established during the course of the next few years.

4. A brief summary of War Department requirements for R. O. T. C. is as follows:

Students enrolling in an R. O. T. C. Unit when they enter an institution where a unit is established enroll for two years' basic course, which comprises three hours per week for two years. At the end of this time, they having sucessfully completed this two years' basic instruction, they may attend a basic training camp of six weeks' duration which, in the case of the Air Service, is with an Infantry Unit. Students who have completed the first two years' basic course may enroll for two years' advanced instruction. At the end of the first year's advanced instruction a compulsory training camp of six weeks' duration is conducted. In the case of the Air Service this camp will usually be conducted at the Air Service Observation School, Post Field, Fort Sill, Okla., where students will receive practical instruction in the air and on the ground in aerial observation and general military subjects. At the end of the senior year students who have successfully completed the advanced course may be commissioned as second lieutenants in the Reserve Corps; and in the Air Service, provided the necessary appropriations are available, these Reserve Officers are immediately called to active duty for a period of six months. During this six months they receive three months' advanced training at an Air Service Special Service School and with a Service Squadron. This procedure will turn out an excellent quality of Reserve Officers for the Air Service and will give some material for regular commissions.

5. An estimate of the present total enrollments in Air Service R. O. T. Units is approximately 526, based on incomplete reports. It is expected that less than 100 will attend the Basic Camp and that approximately 30 will attend the Advanced Camp during this summer.

Lt. Colonel J. E. Fechet, Chief, Training and Operations Group.

FOREIGN NEWS

Italian Fixtures for 1921

A programme for this year has been issued by the National Aeronautical Federation of Italy which promises: (1) Seaplane contests on Lake Garde in May; (2) circuit races at Brescia, during the Brescia motor event week; (3) race Lugo-Trieste-Trento-Lugo, June 10; (4) Schneider cup contest (Venice or Naples), September; (5) seaplanes tour of Italy; (6) an international contest for small touring machines; (7) spherical balloon contest.

Spanish Air Routes for 1921

Ambitious routes are promised in Spain for air traffic during the current year, viz., between Madrid and Paris via Soria and Logrono; Madrid and Barcelona; Madrid-Valladolid-Burgos-San Sebastian; Madrid-Albacete-Carthagene; Madrid-Valdepenas-Cardoue-Seville-Tangiers; and Madrid and Lisbon via the valley of the Tagus.

French Minister Thinks Navies Negligible

André Lefèbre, former Minister of War, asked the French Chamber of Deputies to divert 100,000,000 francs from the Navy budget to the Army.

"We have the greatest Army in the world," said M. Lefèbre, "while among navies we stand sixth or seventh. We cannot gain supremacy on the water, but we must maintain it on land. The next war will be decided by land and air, with the navies negligible."

The Napier "Cub"

In announcing the new Napier 1,000 h.p. aero engine in our issue of February 14th, it was suggested that two "Cubs" would probably be fitted to the *Titania,* a large flying boat which is being built by the Fairey Aviation Company. We have since received an official note from the Air Ministry that the *Titania* and sister boats are to be fitted, as originally designed, with Rolls-Royce "Condor" engines.

British Imports and Exports by Air

The value of imports and exports by air during 1920 exceeded the million pounds mark, the respective amounts being £677,047 and £339,-108 and the grand total £1,016,155.

For the last quarter of the year (October-December), the value of imports and exports conveyed by aircraft were approximately four times greater than for the same period of 1919, although there was a reduction in traffic for the month of December as compared with the preceding months.

The principal classes of merchandise carried during the year were clothes and furs. Among the imports the largest item was one of about £307,500 for women's clothing brought from France. Fur goods amounting to about £78,000 were also carried from France. In the export trade different classes of goods dealt with were more evenly represented. One of the chief items was men's and boys' woolen clothing, etc., to the value of about £27,700.

Among other goods forwarded were watches, electric lamp parts, wireless apparatus, human hair, paintings and cinematograph films.

The Thames As London's Air Port

Alighting experiments on the Thames took place on 8th February, thus marking a further step in the development of a scheme which the Civil Aviation Department of the Air Ministry has been working for some months. The following is the official announcement by the Air Ministry:

Since civil aviation began it has been obvious that air transport in many cases is hindered by the distance of suitable aerodromes from the centers of population.

In the case of London, the River Thames offered the only practicable early solution of the problem of bringing the aerodrome closer to the center of the city, and the various possibilities of making use of the river were submitted to careful investigation.

A detailed study of the river from the Nore upwards showed that the most favorable situation for an alighting area for aircraft is that between Westminster Bridge and Albert Bridge.

In order, however, to make this area available for the use of aircraft, it had to be shown that such use would not interfere with the other users of the river and that no danger to the public would be involved.

The question was, therefore, discussed with the various authorities concerned, amongst whom were the Board of Trade, the Commissioner of Police, and the Port of London Authority; the two latter viewing the matter from the point of view of the public safety and of the other users of the river, respectively.

At an early stage in the discussions it became clear that before further progress could be made the representatives of the Board of Trade, the Commissioner of Police and the Port of London Authority would require actual knowledge of the conditions under which aircraft could work from the water. Arrangements were, therefore, made by the Supermarine Aviation Works, Ltd., to take these representatives for flights from their works at Southampton. During the course of these fights the representatives were enabled to see for themselves the ease with which aircraft are maneuvered in crowded waters.

Owing to the bridges and other restrictions upon the area available for aircraft, a certain definite minimum performance is required for aircraft which could be permitted to use the part of the river proposed.

The Air Ministry Competitions in September last showed that the amphibians which competed, namely, the Vickers, Supermarine and Fairey, possessed the necessary performance. As soon, therefore, as the winning machine, Vickers "Viking Mark III," had become the property of the Air Ministry, as contemplated by the terms of the competition, arrangements for experimental flights to the selected area were put in hand; the authorities interested having been convinced by their previous experience that such experiments could safely be carried out.

A special exemption under the regulations for the particular aircraft used has been granted by the Secretary of State for the purpose of these flights, in order to avoid any question of infringement of the regulations.

The flights on 8th February were for the purpose of allowing the pilot, whose services had been lent by Messrs. Vickers, to become acquainted with the alighting area.

When the results of these first flights have been considered by the authorities concerned, it is hoped to carry out a series of tests under differing conditions as regards weather and tide in order that a definite conclusion may be reached as to whether the use of this area by commercial aircraft can be arranged.

Signposts for Airmen

In the south of England a scheme is being adopted for the guidance of commercial aircraft which is worthy of the attention of municipal authorities in this country. On the roofs of important railway stations the name of the town is painted in large white letters, 15 feet long, thus enabling a pilot on cross-country flights to check his position and reassure him of the name of the town he is passing. The British Air Ministry has recently announced the names of four important towns that have taken up this scheme, while two other places have marked their names in large chalk letters on plots of land adjacent to the stations.

Air Marshal Sir F. H. Sykes on Commercial Aviation

At the annual dinner of the Marine Engineers' Institute at the Hotel Cecil, London, Air-Marshal Sir F. H. Sykes, when replying for the Air Forces of the Empire, put forward a strong plea that the Institute should treat as a whole the development of sea, air and land transport. Among other very sound views he also further emphasized the necessity for military aviation to look for its strength from the commercial side and the reserve which thereby could be built up. Naval supremacy, he said, arose from and depended on our commercial supremacy, and for many years the Navy had looked to the mercantile marine for its reserve of men and material. It was the splendid spirit shown by the men of the mercantile marine which enabled them not only to maintain but to increase the Navy during the war. "If," continued Sir Frederick, "we can only build up an air merchant service and develop such a spirit of devotion in our pilots, I think we need have little to fear in the air in time of national emergency. I have the honor to preside over the department which is responsible for civil aviation, and one of our convictions is that, without commercial supremacy in the air, design staffs and the reserve of pilots, engineers, material and operational and constructional experience gained therefrom, our air forces will never be supreme. For this reason I regard the promotion of civil aviation as essential, not only to commercial enterprise, but to security. During the summer months our transport firms managed to maintain a number of air services to the continent, but these must be regarded to a certain extent as experimental, since the distances are so short that the full advantage of the aircraft's speed cannot be obtained, and it is difficult to enter into competition with the existing means of transport. It is possible that before long experiment will prove that the airship is capable of performing the journey to Egypt regularly in one stage.

"I think, too, that it is highly desirable that each dominion and colony should develop its own civil aviation, and so, linking up with each other as opportunities are offered, and co-operating by exchange of information and a common policy, evolve a co-ordinated imperial air system. Countries like Canada, Africa, India and Australia possess the wide areas required. In Australia there are wide expanses of undeveloped and sparsely populated country which do not warrant the laying down of railway lines, and which can probably be more economically penetrated by air lines. Some interesting schemes have already been thought out for connecting Northern Australia by air with the south, for mail services between Melbourne, Sydney and Tasmania, and, in New Zealand, for mail services between the two islands. I hope these schemes will bear fruit, not only because I am convinced that one day air transport will be the principal mail carrier and a recognized method of travel, but because it is essential for strategical purposes to establish air bases throughout the empire. Shipping interests can render great assistance by utilizing aircraft as complementary or feeders to the main ocean routes. There are many instances of companies having to operate subsidiary routes which are not economically productive. A prominent example is the West Indies.

"It is probably not difficult to maintain an adequate service to Trinidad or Kingston, but the economic carriage of passengers, and more particularly the distribution of mails, beyond these points to the innumerable islands of the Antilles is a much more difficult problem, and the present lack of inter-communication between the islands is a serious drawback to the development of some of our potentially richest colonies. I would, therefore, very seriously commend to the consideration of shipping companies the value of utilizing aircraft in connection with their ordinary services. The same thing applies, of course, to railway communication, especially in countries such as Africa, where railway lines are as yet only laid in sections, and in Canada, where the air can supply lateral services."

Direct Lift Controversy

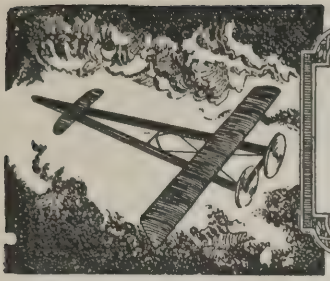
A discussion is going on in France at present as to who was the first to fly in a helicopter. The debate was started by a dispatch from Spain that successful experiments were being made with an aeroplane that rises directly into the air without a preliminary run over the ground. The two French aviators, Damblanc and Etienne Oehmichen, claim to have risen eight feet from the ground in February of last year. Another inventor, Edmond Douheret, says he rose several feet off the ground as early as December 23, 1918, at Saint Cyr.

French Air Budget

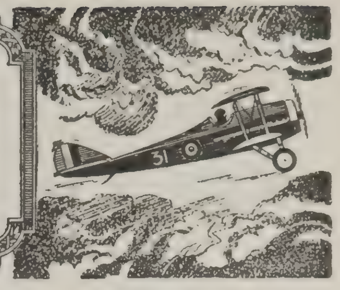
In the French Budget for 1921 the Minister for War asks for 287,-312,670 francs; the Minister of Marine, 50,553,300 francs for home purposes, Algeria, Tunis and Morocco. For the Colonies, 4,805,405 francs are required, and the new Under-Secretary for Aviation puts his amount at 184,683,270 francs. Of the total sum asked for, material for works, laboratories, etc., absorb 454,275,905 francs and 33,215,000 francs are allotted to prizes and subsidies.

Lloyd's "Pilots' Record Book"

Lloyd's have now issued a record book of all aircraft pilots who hold British civil aviation pilots' licenses. Details are given of the pilot's name, address, date of birth, license, type and number, dates between which it is valid, a record of general flying experience, accidents, date of last medical examination, and the types of aircraft for which he is licensed to fly. The *Pilots' Record Book* may be inspected by any person interested, on application to the secretary, Lloyd's Aviation Record, Lloyd's, Royal Exchange, London, E. C. 3.



ELEMENTARY AERONAUTICS *and* MODEL NOTES



A Flying Model of the Orenco Fighter

THE building plans given below show how to construct an accurate scale reproduction of the "Orenco" type D fighting aeroplane. When properly built, according to the details outlined, the model should fly for a distance of one hundred feet or more, according to the skill of the model-maker. No attempt has been made to obtain a record-breaking flyer, as it is our belief that more satisfaction is to be had in possessing a neat and substantial model capable of short flights, and retaining nearly all exterior features of the aeroplane after which it is patterned.

A few words about the Type D fighter will interest those who may admire its appearance. The Type D was designed as a pursuit fighter for the U. S. Army Air Service. At the time of its construction it was the fastest plane in the service; with a 300 h.p. Hispano-Suiza engine, its actual speed over a measured course was 147 miles an hour. (A description of the plane appeared in the March 29, 1920, issue of AERIAL AGE.) At the Pulitzer Trophy Race, last Thanksgiving Day, the Type D won fourth place. During that event the steep banks made close to the ground on turning showed how precisely the plane could be controlled. That machine was provided with balanced ailerons, but differed in no other respect from the general proportions shown on the drawing. The body and fin of the full-sized machine are of mahogany veneer, but to obtain lightness in the model, silk or bamboo-paper covering should be used.

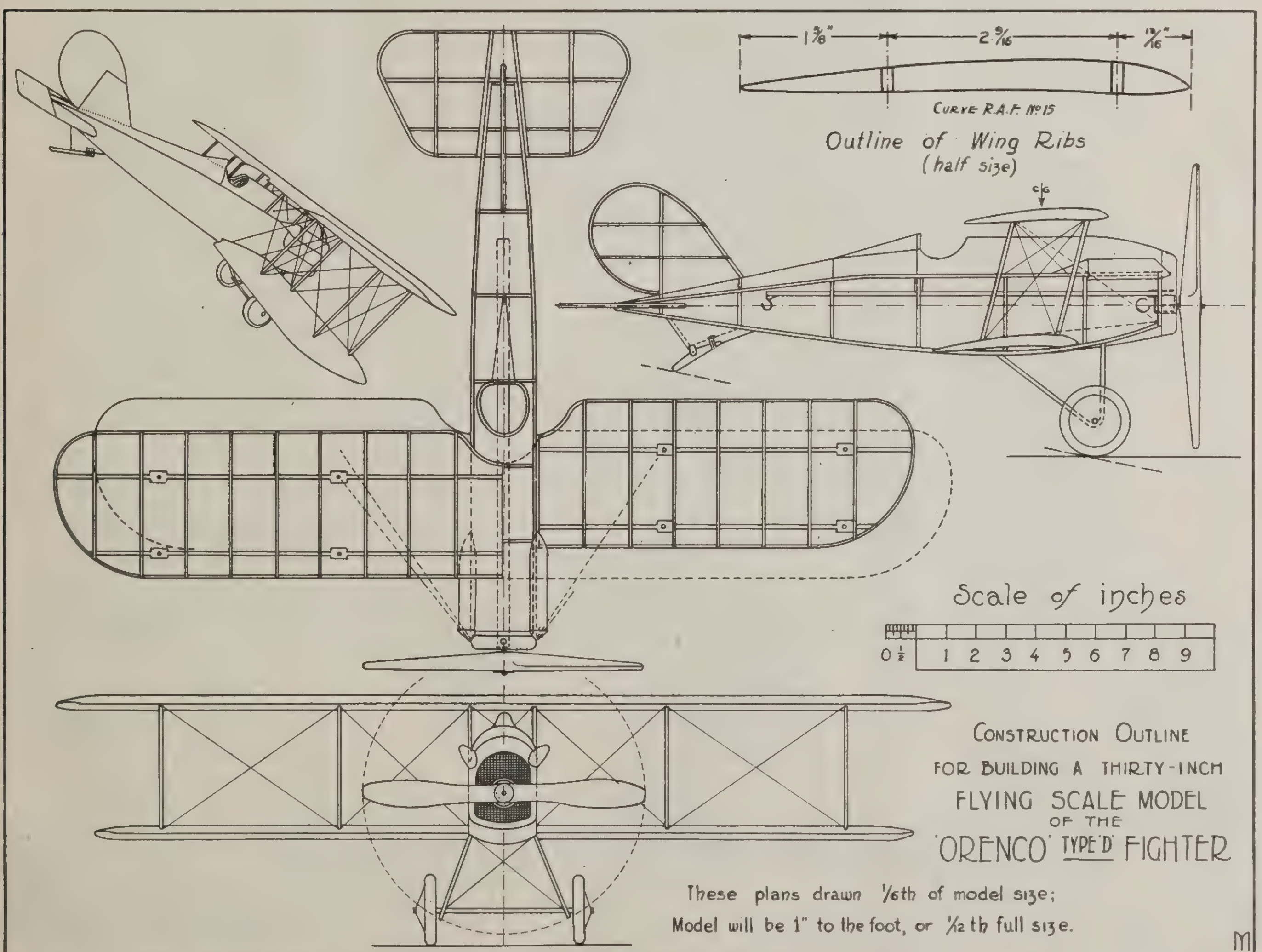
To assist in the reproduction of the drawing it has been made at a scale of exactly one-sixth, so it is possible to take off any measurement and multiply it by six to obtain correct size. Below is a list of general measurements:

	Inches
Span upper wing	30
Span lower wing	27½
Chord of both wings	5
Gap between wings	4¼
Length overall	21½
Height, overall	8½
Propeller diameter	9½

When the model is built to the dimensions given, it will be at a scale of one inch to the foot, or in other words, will measure one-twelfth the actual size of the real aeroplane. This should give the constructor a better idea of real machine proportions than a model not built to definite scale. The builder must recognize the necessity of keeping his details light so as not to exceed the sizes shown, for variations in the construction, if attempted by any but an experienced builder, may be the means of adding too much weight or to weaken the structure.

In next week's issue some notes on the construction will be given in sufficient detail to enable the average builder to follow the proper methods with little difficulty.

(To be continued)



Flying Lullaby

Far above the tallest treetops, where the winds are whispering low,
In a ship up o'er the mountains, guided by a soft moonbeam,
Where the tiny stars are twinkling and the milky ways' aglow,
There your father sails as swiftly as the night flies while you dream.

Hushaby, the day is dying,
Little boys must go to sleep;
In the sky your daddy's flying
While you rest in slumber deep.

In the morning, when the sunshine brings the joy of light again,
You can look into the distance for an airship fair to see.
Nighttime is the hour for slumber for both little boys and men;
Close your eyes and sail for dreamland, take the voyage now with me.

Hushaby, the winds are sighing,
Little boys must have their rest;
In the sky your daddy's flying,
Flying homeward from the West.

Henry F. Pringle.

Absent-Minded

Hurry: "What's happened to Speeder. I haven't seen him for weeks?"

Cane: "Oh, he tried all the different makes of cars and then bought an aeroplane."

Hurry: "Has he crashed?"

Cane: "Well not exactly. He started on a cross-country flight the other day, heard something rattle and absent-mindedly climbed out to look under the machine."

"Who Can Tell?"

Dear Sirs,—About the engine. Well,
We write to let you know
We've waded through the booklet on
"What Makes the Engine Go."
It took us close on half a day
To read through all the guff;
The engine goes all right, but don't
Keep goin' long enough.
It's very good to understand
What makes the engine go,
But why the deuce the d— thing stops
Is what we want to know.
So now we're making this request,
While tears and curses drop,
Please send along a booklet on
What makes the engine stop.
The folk around here all await
With interest your reply:
To them the reasons why she goes
Don't seem to signify.
So while we wait and chew the cud
Don't let the matter flop;
For Gawd's sake write and let us know
What makes the blighter stop.

"Why did you send him home so early?" her father asked. She hummed, "You can't get any loving where there ain't any love."

Smart

"Why did you put on your hat?" she asked. He whistled softly, "Chili Bean."

Fly with Me!

(To Aleta)

Oh, it's up in the air, and far away
O'er the river winding blue—
Oh, it's up in the air, and far away
In a Plane that's built for two.

And, away! away! at break of dawn,
When Spring blossoms scent the air—
It's a bouyant ride,—up, and glide,
With never a fear nor care!

Fly with me dear heart, to-day,—
And, we'll fly—oh, far away!
Away, above the clouds so high
O'er shimmering, silvery Bay.

O'er meadows green,—o'er knoll and hill,
O'er blossoming Valleys, far below—
And, then dear heart, toward the North—
O'er glistening mounts of snow.

How pure and sweet, a Joy like this—
Akin to God's own Thought,—
Ah, sweet and wholesome *is our* joy—
Setting "joyride" autoists thoughts to naught!

Aye,—could two souls fly through this life
In such tranquil bliss and glee—
But you, and only you, dear heart,
Shall always fly with me!

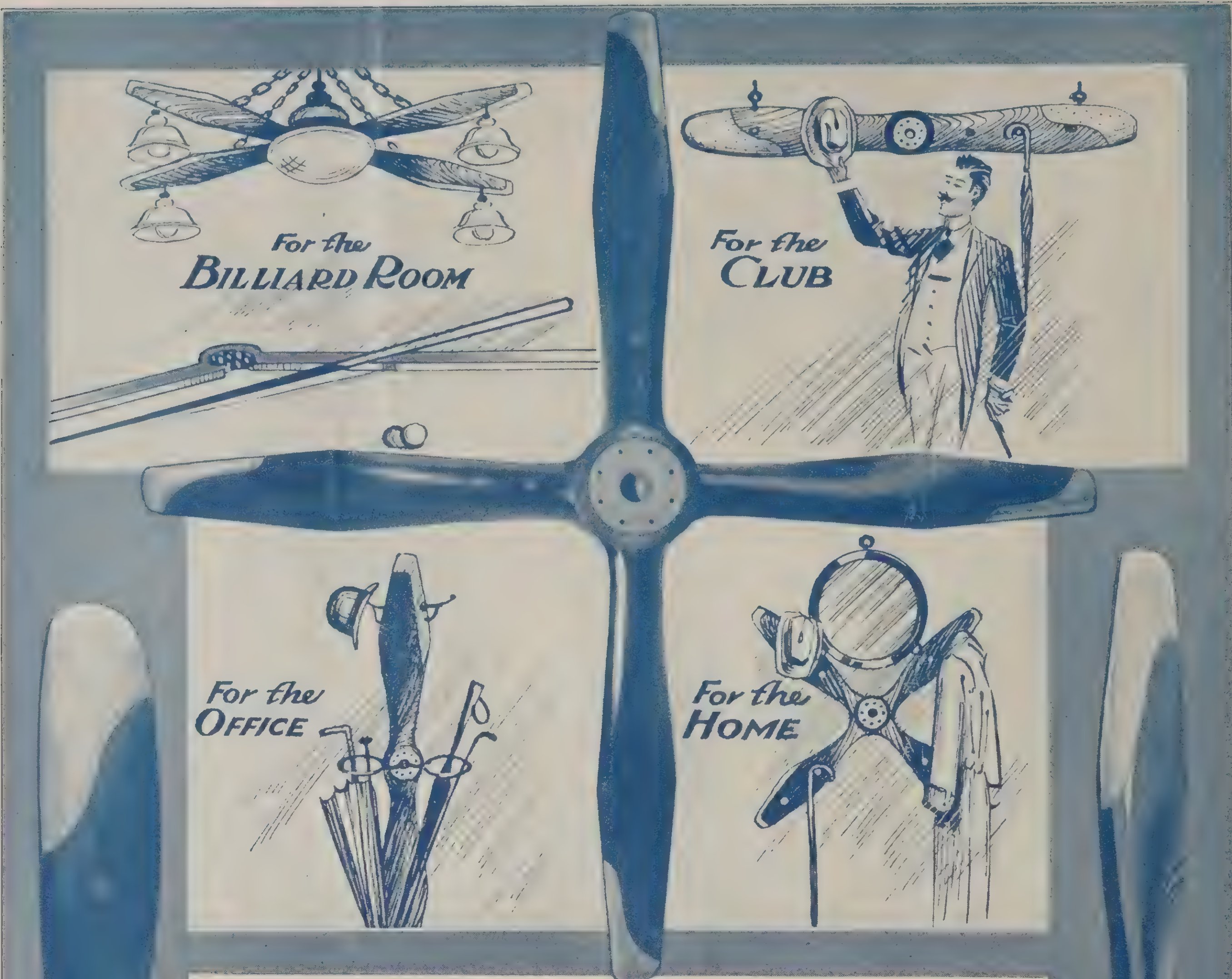
AERIAL AGE WEEKLY

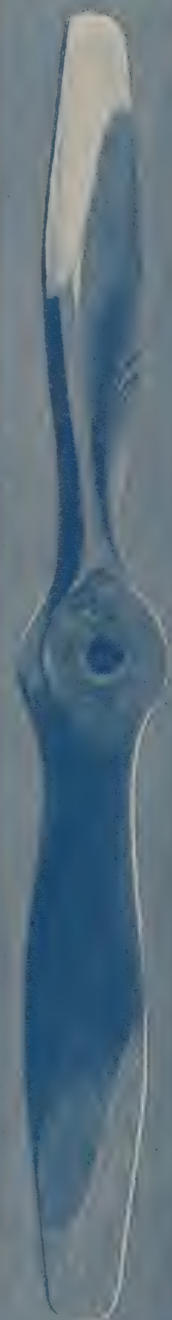
Vol. 13, No. 2 MARCH 21, 1921 10 CENTS A COPY

"Beacon Towers," residence of Mrs. O. H. P. Belmont, Sands Point, Long Island, photographed by Captain James Suydam

A Single Air Service

PUBLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
Subscriptions: Domestic, $4; Foreign, $6. Entered as second-class matter March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879


For the
BILLIARD ROOM
For the
CLUB
For the
OFFICE
For the
HOME



G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

LESLIE V. SPENCER, M.E.
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIII NEW YORK, MARCH 21, 1921 NO. 2

A SINGLE AIR SERVICE

IF it should be the purpose of President Harding to bring about unity of the army and navy air services, or, to put it in another way, to establish a separate air department upon which the army and navy could draw for equipment and trained aviators, he would find high officers of the army and navy opposed to the plan. It is reported in Washington that Mr. Harding has been won over to the idea of a single air department. The General Staff has advocated a distinct army aviation corps. In a letter to Major Gen. Charles T. Menoher, Director of Air Service for the War Department, General Pershing on January 12, 1920, took a very decided stand against the single air service. "A military air service," he said, "is an essential combat branch and should form an integral part of the army," adding that it should "be separate only in the same way that infantry and field artillery are separate."

That is also the view of Major Gen. William G. Haan, who commanded the Thirty-second Division in France. He had an unsatisfactory experience with an American air unit assigned to him until it came absolutely under his control. But this experience cannot be considered a sufficient test of the capacity and usefulness of air units trained in the supple and thorough organization which the proposers of a single service have planned. The argument that efficiency and tactical availability can be obtained only if aviators are "an integral part of the army" has never been convincing. It is the view of the tactician proud of his own service and averse to going outside of it for personnel and material. In the navy, as well as in the army, there is a good deal of opposition to a single air service and for the same reasons.

Great Britain adopted a single air department some time ago. It may not function perfectly, but that is because of its comparative newness. Perhaps the sanest criticism of it is that it has not been entirely independent of Ministerial control. Air Marshal Sir H. M. Trenchard has said that "the work of the Air Service either on land or sea, in spite of its many and various aspects, can only achieve its greatest efficiency if regarded and carried out as a single co-ordinated effort." What the army and the navy want in a campaign is the best aeronautical equipment, together with thoroughly trained scouts, photographers, bombers and mechanics. The need could be best supplied by a service that concentrated all its energies upon maintenance and efficiency and was not embarrassed by army and navy regulations, which too often are not adjustable to sudden emergencies. An air unit assigned to a field force or to a squadron would automatically become an integral part of it, being subject to the commander's orders. Unification of the army and navy air services would obviate duplications and make for economy, and Congress would not be pulled about and confused by the demands of two services. Civilians in Congress, like Senator Wadsworth and Senator New, and like Julius Kahn in the House, are broader and more practical in their views of aviation reform than are the Generals and Admirals who speak only in service terms. The enabling legislation would have its problems, but at hearings of the Military Affairs and Naval Committees they could be thrashed out and a workable law evolved.—*Editorial in N. Y. "Times."*

The Aerial Mail

THE country not only can afford its air mail; it must afford it. Certainly at this time the country wants economy in the operation of its government. But there are some forms of saving which are very bad economy, and we are convinced that the attempt to kill the air mail belongs emphatically in this class. It is no argument to say that the air mail service should be eliminated because it costs more to carry mail through the air than on trains. It costs more to carry mails on trains than on canal boats, but we do not send mail from New York to Buffalo by the Erie Canal because of that fact—though there is some evidence to the contrary.

Those who claim that the air mail service is impractical belong in the class with those who ridiculed the Clermont as she puffed her way slowly but surely up the Hudson. Without the Clermonts of industry there are no Aquitanias. We ought to be thankful that the post office in one instance at least has had the courage to be forward-looking.

If there are unusual dangers involved in the air mail, it is not the part of courage or intelligence to drop the service on that account. The challenge to us is not to eliminate the dangers by leaving the air, but by fully conquering it.—Editorial in *The Outlook.*

The News of the Week

Secretary Weeks Considering One Head for U. S. Air Forces

Washington.—Serious consideration of the proposal of combining the air forces of the government under one head is to be given by Secretary of War Weeks and his views on the question are soon to be placed before President Harding, it was disclosed recently.

Mr. Weeks is known to have pronounced views on the future of the air force of the American military establishment, but does not desire to go into any discussion of this matter until he has had an opportunity to confer with the President. He indicated that within a short time he might issue a statement of his opinions on the proposal of a department of the air.

Secretary Weeks is devoting every available minute to study of the army problem in all its phases.

That he does not favor a standing army of 280,000 men was emphatically made known when in answer to a direct question Secretary Weeks replied in the negative. He agrees with Congress that an army of 175,000 men is ample for peace time needs, but he is seeking to ascertain just what elements should compose this standing army.

Aircraft Liquid Poison Will Annihilate an Army

The chemical Warfare Service has discovered a poison so strong that three drops will kill any one whose skin it touches.

Falling like rain from nozzles attached to aeroplanes, the liquid would kill everything in the aircraft's path, according to a high official of the service. A description of what the new war weapon would do, in the opinion of this official, follows:

"One plane carrying two tons of the liquid could cover an area 100 feet wide by seven miles long in one trip, and could deposit enough material to kill every man in that area, and if those on the ground were not protected by gas masks, the area of fatality would be many times greater.

"The only limit to the quantity of this liquid which could be made is the amount of available electric power, as nearly every nation has practically an unlimited supply of the necessary raw materials. It would be entirely possible for this country to manufacture several thousand tons a day, if the necessary plants were built.

"During the Argonne offensive the entire First American Army of 1,250,000 men occupied an area approximately forty kilometers long by twenty kilometers wide. If Germany had had 14,000 tons of this material and 400 planes equipped for its distribution, the entire army would have been annihilated in twelve hours.

"The chemical Warfare Service is developing protective clothing entirely to cover the wearer and make him impervious to the deadly liquid."

Air Bombers Ask for "Real" Battle

Army aviators have become so enthusiastic over the proposed experiment of bombing naval vessels under approximately war time conditions that scores of them have suggested that the fleet be allowed to fire back at the planes with anti-aircraft guns.

While Admirals and Generals have been advancing and disputing claims that the aeroplane is far superior to the battleship as a war weapon, army pilots have flooded the office of the air service director with pleas that the matter be settled under honest to goodness war conditions.

They have been all wrought up over the subject since that not distant day when Josephus Daniels, then Secretary of the Navy, offered to stand bareheaded on a deck of a battleship and let Brig.-Gen. Mitchell, head of the air service in the war, take a crack at him with a bombing aeroplane.

Lieut. C. C. Moseley, victorious pilot in the recent race at Mineola Field for the Pulitzer trophy would be "tickled pink" at the opportunity of a real fight with the navy gunners.

"I firmly believe," he wrote to his chief, "that a bunch of those gobs would have about as much chance of hitting one of us (especially if the old battleship were in motion) as the proverbial snowball."

Other army fliers, scattered over fields in many parts of the country, chimed in with similar willingness, each one asking to be allowed to take part in the experiment should it ever come about.

Meanwhile in several of the air service flying fields bombing practice against silhouette warships placed upon the ground is being carried on. Official tests with a view to determining the relative value of aircraft in warfare are being conducted at the Aberdeen proving ground in Maryland.

Army fliers say they could sink the biggest battleship with one direct hit with a 1,100 pound bomb dropped from an altitude of 9,000 feet. They contend that the explosive would have such force it would buckle in the plates of the warship, making it impossible to keep afloat.

As to their own safety in air peppered by anti-aircraft ammunition, the army pilots who saw service over the lines in France assert that results of attacks upon aircraft from the land were few, and they point out that all planes brought down were crippled by guns on fixed land mountings, while in the projected encounter with the fleet the battleships would have to keep moving.

Aviator W. Knox Martin, who is arousing great enthusiasm in Colombia. In the front cockpit is Dr. Eduardo S. Guiterrez, and in front Senor Enrique Alford, with his wife, Senora dona Angela Moure de Alford, the first woman to fly in Colombia

Navy Planes Finish Long Trip

San Diego.—Completing a 6,000 mile aerial tour to Panama and return, two of the F-5-L seaplanes in the squadron that left here on Dec. 30 arrived March 10 from their long journey . They landed at the North Island naval air station.

The nine other flying boats making up the squadron came in at five minute intervals.

French Republic Honors Virginia Aviator

The Republic of France, through Ambassador Jules Jusserand, recently presented to the University of Virginia a bronze tablet in honor of James McConnell, former University of Virginia student, and member of the famous Lafayette Escadrille, who fell at Petit, Detroit, March 19, 1917, in an air battle with German planes.

McConnell joined the Lafayette Escadrille in December, 1915, was wounded twice and was credited with accurate markmanship in combat. Flying a plane that bore the emblem of the Hot-Feet, his old college society, he was shot down in a spectacular battle with swift Fokkers at Petit Detroit, a little village near Flavy-le-Martel, and was buried there with honors. The French people erected a monument over his grave in 1917. McConnell, who was thirty years old, was the author of "Flying for France" and many articles on aviation.

Aero Miles City Club

The Aero Miles City Club, Miles City, Montana, was recently incorporated under the laws of the state for the following purposes: (1) To maintain school of flight. (2) Acquire Municipal Landing Field. (3) Maintain plane for quick transport service. (4) Do Aerial Photography. (5) Fair Exhibitions and Passenger Carrying. (6) Sell planes and Service thereon. (7) Aid in securing legislation for Montana which will make it necessary for pilots operating to carry public to show sufficient proof of ability to control plane they are handling.

The club wishes to state that it will extend courtesies to all fliers, whether Army, Navy or civilian, and "can assure them of supplies and good service."

Following are the officers of the club: H. B. Wiley, President; C. B. Calvin, Vice-President; L. K. Hills, Treasurer; Wm. G. Ferguson, Secretary.

Associated Aviation Clubs of Ohio

The Second Annual Convention of the Associated Aviation Clubs of Ohio will be held about June 1.

Dayton Club Hears First Lecture

"Aero Dynamics" was the subject of a lecture given by W. F. Gerhardt, engineer in the special research department at McCook Field, before a class of three hun-

dred employes and officers at McCook Field, Wilbur Wright Field, and the Dayton-Wright Airplane Company at the Engineers' Club, Dayton, Ohio, recently. The lecture was the first of a series of thirty-six.

Five Leap 2,000 Feet and Set Parachute Record

Sacramento.—A record in parachute jumping was set at Mather Field on March 9, when five aviators, Lieutenant Eugene C. Batten, Sergeant Richard Thorne, Corporal Paul Connors and Private Earl Woodgard and Alexis Hartner leaped from the same plane at an altitude of 2,000 feet. Lieutenant E. C. Kiel piloted the plane.

Double parachutes, one strapped to the breast and the other to the back, were used. Just before he jumped from a wing of the plane, each man loosened one parachute and the wind blew it open as the leap was made. The second parachute was opened when the man wanted to lessen the speed of his fall. All landed safely.

Personal Par

Mr. and Mrs. Theodore Benoist of St. Louis Lane announced the engagement of their daughter Miriam to Lieut.-Commander Patrick N. Lynch Bellinger, U. S. N., who was pilot of the NC-1 in the transatlantic hydro-aeroplane flight.

Aero Club of Southern California News

The Aero Club of Southern California has received a barograph from Henry J. Green to record altitudes up to 34,000 feet. An effort is being made to collect money for the instrument fund of the club sufficient to secure a barograph reading to 45,000 feet. Several attempts to establish new aeroplane records for altitude will be made in Southern California, and the balloon pilots in the club have finished calculations looking toward a trial at a 40,000-foot record during the summer.

The Catron & Fisk Aeroplane and Motor Company of Venice is completing a twin-motored triplane which is to be put in service by Mr. Catron between Los Angeles and his ranches in New Mexico. Its construction follows the successful flying and stunt trials of the smaller triplane with 20-foot wing span built by Catron & Fisk.

Robert Hausler, field representative of the Aero Club in Nevada, has reported to the club that the air route between Los Angeles and Salt Lake City via Las Vegas, Nevada, is ready for aviators. An emergency field has been arranged at Yermo, the first stop on the desert from Los Angeles. Low altitude ships will fly around by San Bernardino and Victorville, where fields are established. Several dry lakes are utilized on the desert, making landing places as level as a floor. Anderson Field at Las Vegas is well equipped for aviators, having facilities as good as some of the fields around Los Angeles. A field and arrangements for gasoline are available permanently at Caliente, Nevada. Between Caliente and Salt Lake open country affords landings at all times.

D. D. France and John G. Montijo, representing the Aero Club, have finished a tour of 2,200 miles over the Mojave and Imperial deserts, flying entirely around both deserts and passing over territory which no white man has ever seen before. Mr. France, who is an experienced mining prospector and knows the water holes of the desert, acted as guide. He passed over mines which he discovered and sold and which were in operation. The trips were filled with interest, and without accident except for loss of a tail skid in the sage brush. On one occasion the aeroplane was flown over a large extinct volcano surrounded by an immense lava bed. Considerable data on desert flying was turned over to the Aero Club by Messrs. France and Montijo.

The Aero Trade Board of the Club, a working sub-organization composed of the commercial flying interests, has elected A. W. Briggs, of the Mercury Aviation Company, as chairman and G. Edward Barnhart, of the C. Robert Little Company of Pasadena, a vice chairman for the ensuing year.

Women Aboard Flying Boats in Palm Beach Race

Palm Beach, Fla., Feb. 18.—Society had to keep moving to keep up with to-day's round of attractions. In addition to the bathing and the usual golf and tennis, luncheons, teas and dinners there was a flying boat race between two Curtiss flying boats, in which Frederick Lewisohn and Mrs. Charles L. Harding flew in one boat and Leland Sterry and Mrs. Charles M. Playford in another. The race, which was around Jupiter Lighthouse, a distance of twenty-three miles each way, was won by Mr. Sterry and Mrs. Playford by 200 yards.

Residence of Mr. J. S. Browning, Prospect Point, Long Island, photographed by Captain James Suydam of New York

The AIRCRAFT TRADE REVIEW

N. E. J.

Dayton S. A. E. Meeting

A meeting of the newly organized Dayton Section of the Society of Automotive Engineers will be held on March 22 at the Engineers' Club in Dayton.

The progress which has been made in aeronautics since the war will be the topic which will be treated by four specialists.

G. M. Williams, General Manager of the Dayton-Wright Airplane Company, will talk on Commercial Aviation. His talk is to cover the actual accomplishments in commercial aviation since the armistice and will include the discussion of the progress made and conditions affecting aviation both in this country and in Europe, during which he inspected many of the commercial aeroplane lines in operation.

C. F. Taylor, the engineer in charge of the Power Plant Laboratory at McCook Field, will disclose the developments in power plants and in fuels which have made possible flights at high altitudes, increase in compression ratios, and increase in engine size efficiency.

Propeller Construction will be treated by F. W. Caldwell, Chief of the Propeller Branch at McCook Field. Reversible propellers and the use of steel in the manufacture of propellers will be among the items covered by his talk.

Lieut. C. N. Monteith, Chief of the Aeroplane Section at McCook Field, will speak on Aircraft Design and Performance, paying particular attention to the newer phases of aeroplane construction, such as all-metal planes, internally braced planes, and aircraft design for high speed.

Effect of Varying the Number of Plies in Plywood

In making up plywood for a particular use the question frequently arises, Should three plies or more than three be used to obtain the required thickness? Some data from tests by the U. S. Forest Products Laboratory may be of assistance in answering this question.

An increase in the number of plies results in a decrease in the tensile and bending strength parallel to the grain of the faces and an increase in the corresponding strength at right angles to the grain of the faces.

If the same bending or tensile strength is desired in two directions, parallel and perpendicular to the grain of the faces, the greater the number of plies the more nearly the desired result is obtained. It must be borne in mind, however, that plywood with a large number of plies, while stronger at right angles to the grain of the faces, cannot be so strong parallel to the grain of the faces as three-plywood, and hence a three-ply panel is preferable where greater strength is desired in one direction than in the other.

Where great resistance to splitting is necessary, as in plywood that is fastened along the edges with screws and bolts and is subjected to forces through the fastenings, a large number of plies affords a better fastening.

It is common experience that a glued joint is more likely to fail when thick laminations are glued with the grain crossed than when thin laminations are glued. The same weakness exists in plywood when thick plies are glued together. When plywood is subject to moisture changes, stresses in the glued joint due to shrinkage are greater for the thick plies than for the thin plies. Hence in plywood constructed with many thin plies the glued joints will not be so likely to fail as in plywood constructed with a smaller number of thick plies. (*Technical Note from Forest Products Laboratory.*)

Personal Pars

The U. S. Air Mail Service has appointed Archibald Black, of the firm of A. & D. R. Black, Consulting Engineers, Washington, D. C., as Aeronautical Engineer.

S. A. E. Aeronautic Division

The personnel of the Society of Automotive Engineers' Aeronautic Division for 1921 is as follows:

AERONAUTIC DIVISION

H. M. Crane, Chairman; Glenn L. Martin, Vice-Chairman; C. DeF. Chandler; V. E. Clark; W. L. Gilmore; L. M. Griffith; G. E. A. Hallett; J. L. Harkness; J. C. Hunsaker; F. M. Kraus; L. B. Lent; G. C. Loening; G. J. Mead; W. H. Phipps; H. C. Richardson; W. T. Thomas; R. H. Upson; C. M. Vought; P. W. Wittemann.

Controls Subdivision: V. E. Clark, Chairman; L. B. Lent; G. C. Loening.

Dope, Cement, Varnish and Glue Subdivision: W. T. Thomas, Chairman; J. C. Hunsaker; J. J. Moosmann; C. E. Waters; P. W. Wittemann.

Materials Testing Subdivision: G. L. Martin, Chairman; J. C. Hunsaker; J. B. Johnson; J. S. Macgregor; H. C. Richardson; C. E. Waters; P. W. Wittemann.

Performance and Testing Subdivision: G. L. Martin, Chairman; V. E. Clark; H. M. Crane; J. C. Hunsaker; Alex Klemin; K. M. Lane; L. B. Lent; G. C. Loening; H. C. Richardson; W. T. Thomas; C. M. Vought.

Powerplant Subdivision: G. E. A. Hallett, Chairman; F. W. Caldwell; Frederick Charavay; L. M. Griffith; E. J. Hall; F. M. Kraus; L. B. Lent; G. J. Mead; C. M. Vought; L. M. Woolson.

Tires and Wheels Subdivision: C. M. Vought, Chairman; J. V. Costello; J. L. Harkness; J. C. Hunsaker; L. B. Lent.

Wire and Fittings Subdivision: G. L. Martin, Chairman; J. V. Costello; J. C. Hunsaker; G. C. Loening; H. C. Richardson.

Emery H. Rogers, on the left, president of the Pacific Airplane & Supply Company, of Venice, Cal., and proprietor of the Rogers Airport, the municipal flying field of Los Angeles. Mr. Webster, on the right, is associated with him in both these enterprises, which rank among the largest commercial flying interests of Southern California

A Stabilizing Raft for Mooring Airships Over the Sea

A short description is given in this article of a scheme for mooring airships at sea by utilizing a raft fitted with special stabilizing planes.

The raft is used as an aft mooring, the forward end of the ship being moored to an ordinary buoy, either by the 4-point suspension or the "metallic V" principle.

Various drawings are given showing the design of the raft suggested. (*Aeronautics*, Feb. 10, 1921.)

The Friction of the Air

This is the first part of an article on the theory and experimental determination of the air friction on plane surfaces, bodies of revolution and other examples. Lord Rayleigh's dimensional theory is referred to, and also Zahm's experimental results for flat planes; Gibbon's experimental results, which confirm those of Zahm, are also discussed in the article. (A. Touissant, *L'Air*, Nov. 5, 1920.)

Book Review

STRAIGHT BUSINESS IN SOUTH AMERICA, *By James H. Collins*, is a book that goes right to the heart of business conditions as they actually exist today. A book that any business man can use as an infallible guide to the right way to create, build and hold South American trade.

James H. Collins is a writer whose opinions command the entire respect of business men the country over. He is a trained observer who has made the field of business peculiarly his own. He indulges in no flights of fancy or romantic visions of what *might* be accomplished in South America—he tells you in a plain matter-of-fact and practical manner *what* to do and *how* to do it.

For eight months he studied trade conditions in the Latin-American republics. In his travels he covered five South American countries. He investigated from the standpoint of a practical business man. In village, town and city he interviewed the leaders in the business as well as the social life of the community. He left no stone unturned in his search for information of vital importance to the American business man. What he found is set forth in this book in entertaining form.

He points out the reasons for the failure of so many American concerns to hold their South American trade once it is secured. He tells why English, German, French and Spanish firms are successful in wresting this business away from the Americans. He analyzes the methods of these European competitors and indicates how they may be utilized by Americans. It is an Appleton book.

AEROYDNAMICS AT VERY HIGH SPEED

By LIEUT. COLONEL A. GUIDONI

Air Attache to the Royal Italian Embassy

THE continuous increase of aeroplane speed is an outstanding feature of the means of this locomotion. Some aeroplanes have reached 275 feet/s on the ground, that is to say 200 miles per hour.

The air navigation at a very high altitude will probably permit them to reach higher values of speed.

The object of this research is to verify if aerodynamical laws that are now applied to aircraft construction can also be used for the coming extra fast types.

I think the problem could be solved very easily, if we could make some methodical tests in a special wind tunnel, which tunnel, though, ought to have the following requirements:

1st. Speed of wind, not less than 1,300 miles per hour.

2nd. Density of the air to be reduced to the conditions of an altitude of 60,000 feet.

Wind tunnels of this kind do not yet exist.

At McCook Field, the Engineering Division of the Air Service has a little tunnel for propeller-blade tests, in which a speed of 450 miles per hour can be reached and this is the only wind tunnel where such a speed can be reached that I know of in the entire world.

In Paris, the Artillery Experimental Institute, during the war used a very simple system in order to confront the ogive shape of shells. There was a compressed air tank, and the shell was presented to the air jet that came out from a Venturi tube applied to the tank.

As we see, both of these systems are insufficient for our purposes.

The balistics can give us some elements to define the air drag at a very high speed. Balistics have studied of course the drag of the different shape shells. The results have been reunited in balistic tables.

In this article I refer to the balistic tables of Col. Siacci, a well-known Italian scientist, and to the research of the French officer Charbonnier.

The first time I examined the balistic tables, I believed there were some mistakes. The conclusions were different and in some cases opposite to our aerodynamical laws.

But a further study showed me that the opposition was only apparent and depended from the fact that the balistical speeds are much higher than the usual aeroplane speed.

From the other hand we know that coefficients K_x — K_y vary when the test speed increases from 0 to 160 miles per hour. It is natural that the change continues and increases when the speed goes up and reaches some thousand miles per hour.

Balistic laws state that the shell drag depends entirely from its ogive shape, to say the conic angle of its point. In fact, the drag of a shell is the product of a shape factor for a quantity which depends on the speed.

The shape factor is the report between the drag of the shell and that of a normal shell which has the ogival radius equal 1.5 diameter.

This conclusion is very strange for an aeronautical engineer because, according to it, the after form would not have any influence on the drag at all, while our aerodynamical tests show the contrary, that is, the drag of a fuse is much less than that of a bullet. In fact, in Fig. 1 I have reported the trajectory of two Navy bullets of 12"; one of normal shape and the other of fusiform shape; the second trajectory is calculated, applying the coefficient values K_x, which are furnished today by wind tunnel tests.

We can see that the fusiform bullet would have an increase in the range of 32%. These theoretical results are not confirmed by practice because all balistical tests made with fusiform bullets have proved that range's increase is only 10% in certain cases and in others is not appraised.

We must admit that at a very speed the influence of the after parts is very little, and perhaps nothing at all.

I think that balistical tests can give us the explanations of this phenomenon.

Balistical tables show that the drag coefficient K_x is not constant at all, but changes very irregularly with the speed and the shape of the body when the speed surpasses a certain value.

If we use the usual formula:

$$R_x = K_x.S.V^2$$

where S is the cross-section, V the speed, the drag coefficient K_x has the following values:

speed miles per hour	per sq. feet	
0 at 540	0.00064	constant
540 + 630	0.00064 + 0.00077	inc. with V
630 + 770	0.00077 + 0.0016	inc. with V^4
770 + 950	0.0016 + 0.00195	inc. with V
950	0.00195	max.
950 up		dec.

The graphs of the coefficient drag K_x against speed give a better idea than the table.

For a sphere the graph is analogue but not identical.

speed miles per hour	K_x	
0 at 540	0.00051 + 0.0010	
420 at 840	0.0010 + 0.0028	inc. with $\frac{V^2}{18}$
840	0.0028	max.
840 up		dec.

That is to say that the sphere has less

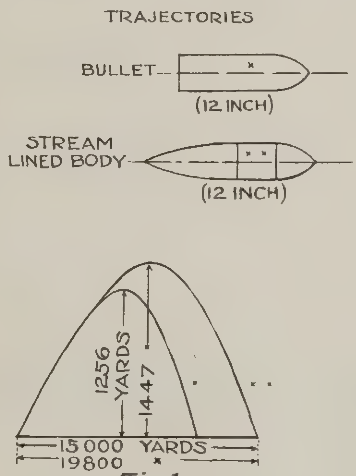


Fig. 1.

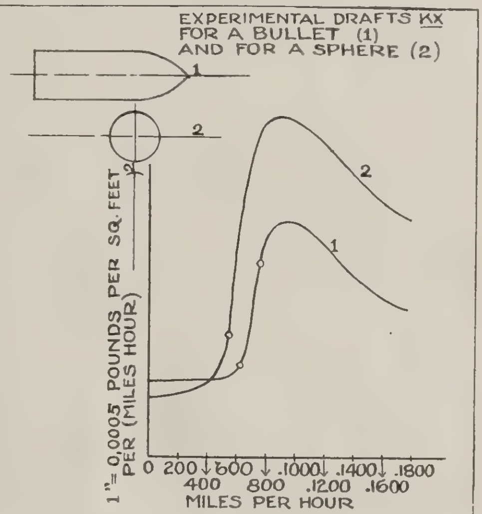


Fig. 2.

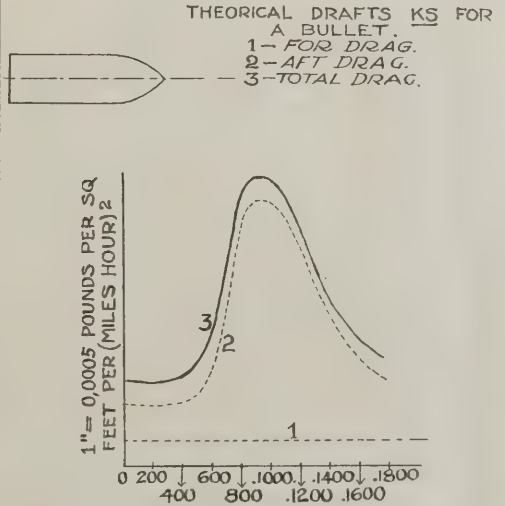


Fig. 3.

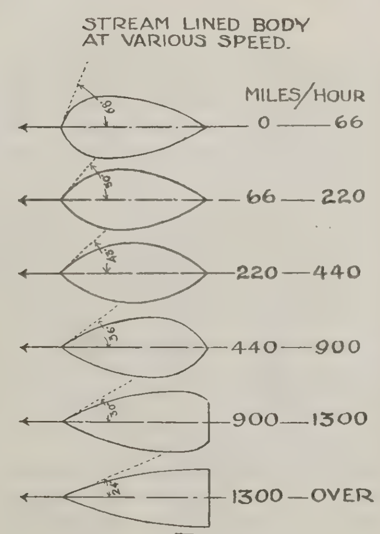


Fig. 4.

resistance at a little speed than the normal bullet and more at a higher speed. The last part of the graphs from 900 miles per hour up is taken from the tables of Charbonnier.

The air resistance for any body like a bullet is the total of a fore pressure and aft depression.

The fore pressure, or direct drag, increases with V^2 indefinitely, but the aft depression can grow at maximum until the absolute vacuum.

When the speed has reached the value for which the aft depression is 30" vacuum, it is understood that with any other increase of the speed the depression cannot grow any more. The resistance from this speed up is formed by the pressure which continues to grow with V^2 and by the constant aft depression.

In graph 2 it is very easy to distinguish the various phases. Until 540 miles per hour the change of depression is very little and the coefficient K_x does not vary very much. When the speed increases, the depression increases also very fast and when the speed has reached 950 miles per hour, or 1,300 feet per second, the depression is practically equal to 30", and from then on the drag coefficient returns to decrease.

Now we think that the same phenomenon will happen for the fuse body; in the fuse we have a fore pressure, and, according to the tunnel's tests, an aft pressure instead of a depression; but nothing says that this special distribution will remain when the speed is increasing until very high values; we think that the fore pressure in a fuse will increase against speed indefinitely; but the aft pressure will decrease and then change itself in a depression, when the speed is more than $500 + 600$ miles per hour. When the depression has grown until absolute vacuum, it remains constant, like that of the bullet.

Our belief is confirmed by the fact that the speed of 950 miles per hour, or 1,300 feet per second, is very near that of the air jet from a tank with one atmosphere of pressure.

A second confirmation is given by the graphs of the sphere. At a very high speed the sphere is more resistant than the normal bullet because at such a speed the drag depends exclusively from the fore pressure. At a very low speed the sphere is less resistant because it has an aft form which supports a pression instead of a depression.

A third confirmation is given by the calculation of the drag coefficient K_x for the bullet body, supposing its drag is the combination of a fore pressure and an aft depression which reaches the vacuum against speed. = 1,000 miles per hour.

$$K_x = K_1 \text{ (fore)} + K_2 \text{ (aft)}$$

As the Aerodynamical Laboratory of the Turin's University has done some very interesting tests to find the distribution of pressure on bullet shapes for 70 miles per hour, we are able to find the value of K_1 (fore pressure) and K_2 (aft depression) at this speed. The value of K_1 is constant, then it is very easy to find the values of K_2 at various speed, greater than 1,000 miles per hour, by the formula

$K_2.S.V^2 =$ absolute vacuum pressure.

If we add K_1 and K_2 we find a graph very near the experimental ones of Charbonnier and Siacci. (See graph 3.)

Conclusions

From the precedent discussion we draw the following conclusions:

1st. It seems very probable that it is not necessary to give the bullet the fusiform shape so as to lessen its resistance. It is known that the German bullets of long-range guns (Bertha) had a very long and fine ogive and no fuse.

2nd. It is probable that the actual streamline shape of minimal drag will be changed when the speed surpasses 450 miles per hour.

I think it will be necessary to give the fore part a finer shape, while the aft can be rounded; the cross-section must be moved aft. And if aircraft with the speed of a bullet will be built, the fuselage, the struts and other parts will perhaps have also the shape of a bullet.

Graphs 4 show the longitudinal section of a stream-lined body at various speeds without changing its length and its cross-section, which depend on the stresses for support.

I think that the wing's curve for higher speed aeroplanes will be very different from the present one, and the tests made at the McCook Field tunnel are sufficient to give an idea of the new phenomenon.

But in this kind of research balistic cannot help us, and it is not possible to discuss this problem today.

If, as many think, the aeroplane must reach the fantastic speed of the bullet, I am sure that the aerodynamical knowledge of today will be subject to many changes in the way I have exposed it.

DEVELOPMENT OF AERONAUTICAL ENGINES BY THE ARMY AND NAVY

Development of certain types of engines by the Army and Navy Air Services has been recently approved by the Secretary of War and the Secretary of the Navy upon recommendation of the Aeronautical Board.

These engines have been arranged into three groups, namely:

(a) Engines, the development and use of which are of mutual interest to the Army Air Service and to the Navy Air Service.

(b) Engines, the development and use of which are primarily of interest to the Army Air Service.

(c) Engines, the development and use of which are of interest primarily to the Navy Air Service.

In thus dividing these engines into three classes, it should be noted that class (b) and class (c) will, by the process of elimination in a great many cases, be merged with class (a). It is believed that engines now placed in class (b) will never be entirely without interest and value to the Navy Air Service, nor will engine for the present placed in class (c) be entirely without interest and value to the Army Air Service. The list of engines by class is as follows:

Class (a) Of mutual interest to the Army and Navy Air Services.

50-60 H.P.: An engine of this power is available but further development of this type of engine has been assigned to the Navy Department.

350 H.P. air cooled radial engine: This engine is placed in this class on account of the maneuverability that can be given to an aircraft equipped with it, reduction in area of vulnerable parts, and a wide range of atmospheric temperature in which it will probably be capable of operating. The development of this engine is now in hand under Army cognizance.

550 H.P. water-cooled engine: For medium weight heavier-than-air craft. An engine of this type is in process of development in commercial hands. Tests are being conducted under Army Cognizance and modifications are being recommended by the Army Air Service.

700 H.P. "W" type water cooled engine: For heavier-than-air craft of large size. This type of engine is in process of development under Army cognizance.

1,000 H.P. "W" type water-cooled engine: for aircraft of heavier-than-air type of extremely great size, now in process of design by the Army Air Service.

Engine to operate on heavy oil fuel, probably about 500 H.P. The development of this engine is of mutual interest, in view of the existing fuel situation and in view of the desirability of eliminating, to as great an extent as possible, fire hazards existing in the use of present type aviation (aeroplane) engine fuels. The development of an engine of this type has been undertaken under Navy cognizance.

168 H.P. 6-cylinder water-cooled engine: This engine is being developed under Army cognizance as an engine for installation in aircraft used in training. The development of this engine and of the engine noted under class (b) of approximately the same H.P. but of radically different type is being carried on with a view to determining which of the two types is the more suitable for a standard engine for this purpose.

300 H.P. cannon engine: This engine is being developed under Army cognizance, for installation in an aircraft where it is desirable to have a gun of greater than small arms calibre capable of firing directly ahead through the propeller hub.

350 H.P. to 375 H.P. water-cooled engine: This engine is to be developed and has been a subject of study by the Air Service of the Army for use in installation in pursuit aeroplanes. The engine contemplated is primarily of the highest performance type, will be highly stressed, of very light weight, and probably of only moderate durability, since the nature of the service to be performed has to justify a design of these characteristics.

300-400 H.P. 6-cylinder water-cooled engine: Engines of this type are being developed under Navy cognizance for installation in rigid airships, or in large non-rigid airships.

Class (b): Engines primarily of interest to the Army Air Service.

140 to 160 H.P. air-cooled engine: This engine is being developed under Army cognizance as an engine for installation in aircraft used in training.

Class (c): Engines of primary interest to the Navy Air Service.

200 to 230 H.P. radial air-cooled engine: This engine is being developed under Navy cognizance as a step towards the development of a durable, relatively cheap engine for training purposes, or for small shipboard aircraft. It should be noted that this engine is of a greater power than either of the engines being developed under class (a) for training purposes and of less power than the 350 H.P. air cooled engine being developed under class (a). Its development is desirable for training purposes since the requirements of the Naval Air Service are such that greater powers are needed in aircraft for training than are required by the Army Air Service. Likewise, it is desirable to have available an engine of domestic manufacture

(*Continued on page* 36)

AVIATION IN CALIFORNIA

An excellent demonstration of the state of the aviation industry in Southern California was shown by the aeroplane races arranged by the Aero Club of Southern California in connection with the national automobile championships at the Los Angeles Speedway on February 27th. All army and navy entries were withdrawn in accordance with the present military and naval policy, and the races were left to the civilian pilots. As the club had secured thirty-two entries of this sort the lack of army and navy aviators did not cause so much consternation as might be the case in other sections of the country.

Following the experience gained from the winter air tournament at Long Beach in Christmas week, the contest committee decided to classify rather than to handicap the entrants. Four races were arranged from the list of entries, beginning with the fastest ships and ranging down to the "Jennie class." This was taking a chance of making a small showing in case of dropping out of any number of entries in one class, but did not result in calling off any of the races.

The first race, for the fastest ships, was a non-stop contest from the Speedway to San Diego and return, a flight of 240 miles. The morning was foggy along the coast and over the mountains, and it was decided to postpone the race. It will probably be flown off some time in March or April from one of the fields around Los Angeles. The prizes in this race totaled $500 in cash and included the Albert H. Hayes trophy award for 1921.

The second race, the "Sport Planes Special," was a sprint of thirty-six miles with six entrants. The little canary-colored Catron-Fisk triplane with its wing spread of twenty feet was a favorite in this, but although it developed a speed of more than ninety miles an hour, it could not pass Earl Daugherty's Polson Special. The triplane took second place, with the Polson baby biplane, winning first, and Joseph Hoff's biplane won third prize money. The entries in this race were: B. H. De Lay, Venice, Cal., Curtiss special piloted by B. H. De Lay; Sierra Aircraft Company, Pasadena, Curtiss piloted by Peyton Gibson; Catron & Fisk Aeroplane & Motor Company, Venice, Cal., and Santa Fe, New Mexico, triplane piloted by E. L. Remelin; Joseph Hoff, Venice, Hoff Special piloted by H. E. Patterson; R. I. Short, Los Angeles, Barnhart Special piloted by Wallace Timm.

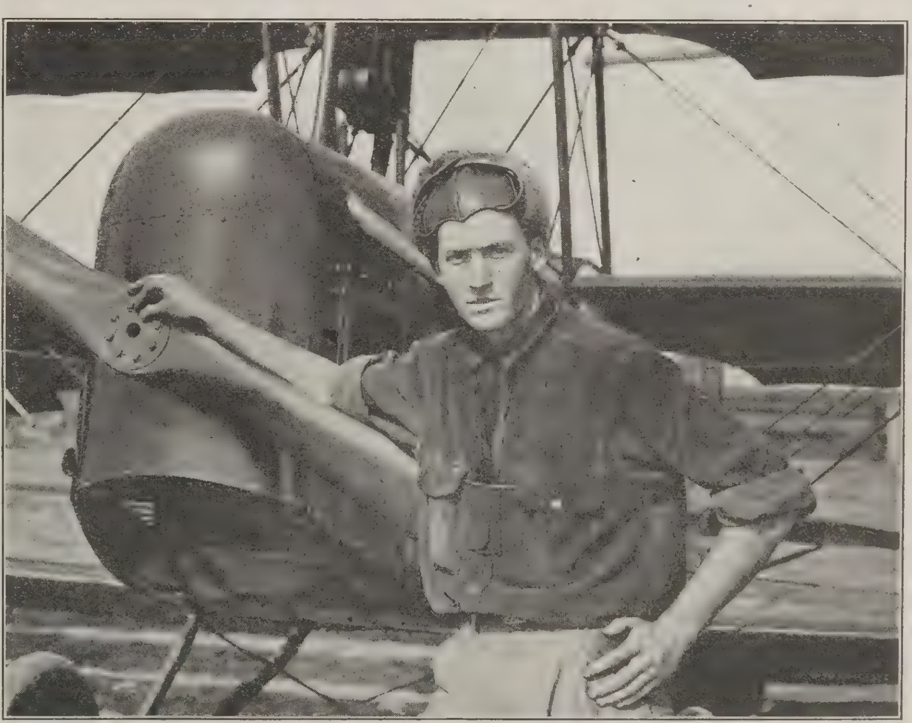
The third race, the "Commercial Derby," followed. It developed into a pretty contest in which E. C. Robinson's flying skill and ability to bank the turns won him first place. M. A. Moltrup of Venice, flying his own biplane, won second prize money, and third, fourth and fifth prizes were taken respectively by Earl S. Daugherty, Mercury Aviation Company and the Rogers Airport. The entries were: Kinner Airplane & Motor Corporation, Kinner Airster piloted by W. B. Kinner; Rogers Airport, two Pacific Standards piloted by Emery H. Rogers and Francis Hawks; Bluebird Airplanes, Inc., the "Desert Rat" biplane piloted by John G. Montijo; M. A. Moltrup, Curtiss JN4-D piloted by himself; Mercury Aviation Co., Curtiss JN4-D piloted by A. C. Mann; Miss Neta Snook, Canadian Curtiss piloted by herself; Hubert Kittle, Curtiss JN4-D piloted by himself; Jack Payzant, Curtiss JN4-D piloted by himself; E. C. Robinson, Curtiss JN4-D piloted by himself; Jack Giddings, Canadian Curtiss piloted by himself; Earl S. Daugherty, Canadian Curtiss piloted by himself; Frank Clarke, Canadian Curtiss piloted by Wally Timm.

One of the most remarkable air tours undertaken in California was made by D. D. France and John G. Montijo in behalf of the Aero Club of Southern California around the Mojave and Imperial deserts. The flights totaled 2,200 miles and were over desert regions which would have required months to traverse and part of which has never been flown over

The last race, the "Aero Club Classic," was the most spirited contest and showed some thrilling brushes. The skillful pilotage of Frank Clarke, E. L. Remelin and Frederic Whitney, veteran aviators and noted around Los Angeles for their flying ability, brought the crowds to their feet on several turns. Whitney had a slower machine and had to fight for third placing. Clarke won the first prize purely on his head work in outflying the rest of the contestants. More than once he and Remelin were flying wing to wing, and on one turn they banked and turned as if tied together. Clarke made the six seven laps of a six-mile course in 21 minutes 5 seconds and Remelin finished second in 21 minutes 32 seconds. Russell Reed nosed in third in 22 minutes and 5 seconds, beating Whitney by 45 seconds. The entrants in this race were: H. J. Crawford, Venice, Cal., Canadian Curtiss piloted by C. Dergunia; B. H. De Lay, Venice, Circe Special piloted by B. H. De Lay; Mercury Aviation Co., Beverly Hills, Cal., Lincoln Standard piloted by E. L. Remelin; Sierra Aircraft Co., Pasadena, Sierra Standard piloted by Leon T. Eliel; L. C. Brand, Burbank, Cal., Curtiss JN4-H piloted by G. G. Budwig; Albert H. Hayes, Pasadena, Pacific Standard piloted by Frederic Whitney; Earl P. Cooper Co., San Francisco, Hall-Scott Standard piloted by Russell Reed; Geo. F. Stephenson, Los Angeles, Hall-Scott Curtiss piloted by Frank Clarke.

The postponed cross-country race had as entries the new Lepere type biplane owned by L. C. Brand, a Junkers-Larson all-metal monoplane owned by the Mercury Aviation Company, a Hall-Scott Fokker owned by the Hall-Scott Motor Car Co., and a Curtiss Oriole owned by the Earl P. Cooper Company. It is probable that the delay may permit entry of one or two Voughts and perhaps the new monoplane built by Jacuzzi Brothers in Oakland.

Thirty-five thousand people saw the races, and as the inside and outside crowds at the Long Beach air tournament were estimated at 160,000 the Aero Club of Southern California feels that it has made an entertainment start for 1921. An aviation exhibition of international character is planned by the club to be held at the Los Angeles Speedway next July. Intermediate dates have been cancelled out of courtesy to the Yolo Fliers' Club of Woodland, California, which plans an aviation racing event on its field at Woodland in the middle of May.



One of the surprises of the two large aviation contests held in Southern California at Long Beach and the Los Angeles Speedway was the little triplane manufactured by Catron & Fisk of Venice, Cal. It is being flown daily around Los Angeles by William K. Gawley and as the wings are painted a bright oriole color the little triplane attracts attention where aeroplanes are ordinarily not noticed

THE HAWA COMMERCIAL TRIPLANES

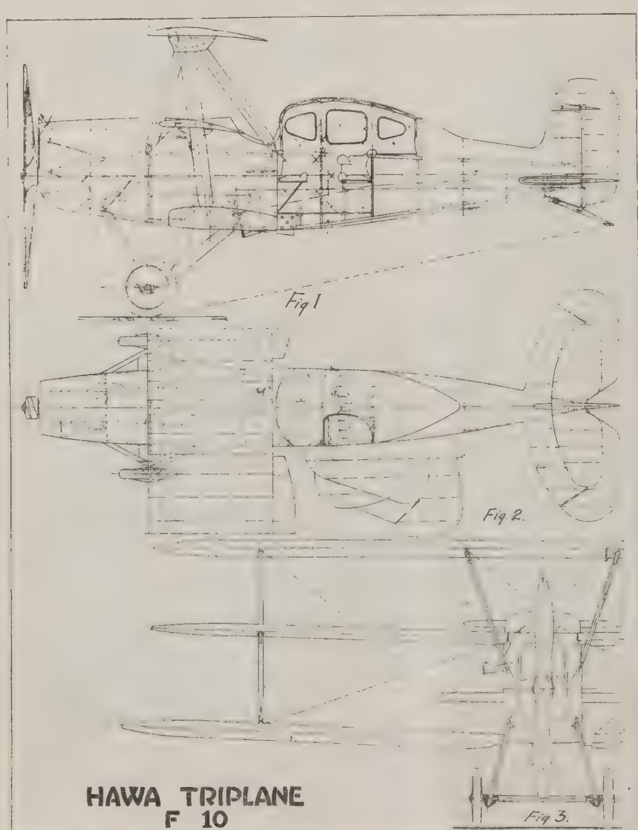
By BENNO R. DIERFELD

DURING the war triplanes in some cases were used as well by the Germans as by the allied armies; however they are seldom applied for peace purposes, because they generally have not as high speed as biplanes. The triplanes produced by the Hannoversche Waggonfabrik (abbr. Hawa) at Hannover-Linden, are known by their comparatively great speed, combined with a very high degree of stability, so that these machines are especially adapted for passenger and mail traffic. The Hawa triplanes have rather unusual design and are pure peace products, as the Hawa Co. during the war was only building monoplanes and biplanes. The smaller type F-10 is represented with elevation, plan and front view in the scale drawings Fig. 1-3, while Fig. 4 and 5 show two photos of this interesting machine and Fig. 6 the cabin interior.

The hull is built of three-ply wood and has at the front end a six-cylinder Benz engine of 220 H.P. that is completely enclosed by a metal sheet casing. The engine drives the two-bladed propeller of 3.00 metres (118.1 in.) diameter. The front of the hull is formed by the radiator for the cooling water. There are two main fuel tanks that feed with small fuel pumps the carburetors of the engines; an emergency gravity fuel tank is arranged at the upper wing. By dividing the fuel storage a greater safety of service is gained.

Between engine and pilot seat a special luggage room is provided for giving shelter to light trunks, mail parcels, etc., up to 200 kilogrammes (440 lbs.) weight. Besides that, this luggage room serves other purposes; at first it forms a sort of shock absorber between pilot's seat and engine at head falls of the machine, and as the passenger cabin is then arranged more at the back of the pilot's seat, this also serves as shock absorber for the passengers. Furthermore, by this arrangement of the luggage room the engine is separated from the main part of the fuel and the danger of conflagration at carburetor fires, etc., is minimized. As the middle or intermediate wing keeps in line with the upper edge of the hull,, the pilot has unhindered sight to front and sides across the luggage room and engine.

Behind the pilot's seat the passenger cabin is arranged that has two club chairs in flying direction and two folding seats at the front wall of the cabin. At the back of the rear seats a room of 0.75 metres (30 in.) length is provided for carrying away suitcases, top coats, etc. The length of the cabin is about 2 metres (78.7 in.), its width 1.00 metre (39.4 in) and the heigth 1.5 metres (59 in.). The interior walls of the cabin are thickly upholstered with leather, so absorbing any shocks



or engine noises. In every side wall three windows are provided, two of them can be opened at will; in the front wall two bull's-eyes are arranged. An adjustable heating is also provided; the entrance door is at the left side of the cabin and can be opened from inwards by handle, from outwards by key.

The hull tapers off to the rear end, where the lower plywood stabilizer with the divided elevator are arranged. An upper adjustable smaller stabilizer, operated by the pilot, is also provided, and serves for balancing the weight of missing passengers, too heavy luggage, etc. The rudder at the rear end is the usual type, as well as the running gear. The wings have the same span and are staggered; the upper wing is trapezoïd with rounded corners. The lower wing has the same form and bears the ailerons; the intermediate wing is

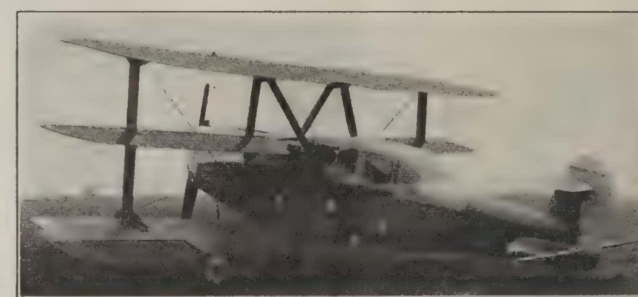


Fig. 5

narrower and has Blériot form. The three wings are connected by one strut of stream line section; the upper wing above the hull is supported by two oblique triangle struts. Though the machine looks somewhat clumsy, it has the high speed of 170 kilometres (105.6 miles) per hour; this, combined with a high stability, not possible with a monoplane or biplane, makes the Hawa F-10 to an ideal traffic aeroplane.

The specifications are:

Span	11,546 metres (37.8 ft.)
Width (upper and lower wing)	1.70 metres (5.57 ft.)
Width (intermediate wing)	1.20 metres (3.93 ft.)
Length overall	8.19 metres (26.8 ft.)
Height	3.90 metres (12.79 ft.)
Stagger of wings	0.3 metres (0.98 ft.)
Gap between upper and intermediate wing	1.21 metres (4.0 ft.)
Gap between intermediate and lower wing	1.38 metres (4.55 ft.)
Tread of landing gear wheels	1.8 metres (5.9 ft.)
Wing area	45 square metres (484.3 sq. ft.)
Wing loading	30-35 kilogrammes/sq. metre (6.14-7.16 lbs../sq. ft.)
Speed	170 kilometres (105.6 miles) per hour
Useful load	700 kilogrammes (1,543 lbs.)
Range of action	750 kilometres (466 miles)
Gasoline consumption	53 kilogrammes (116.8 lbs.) per hour

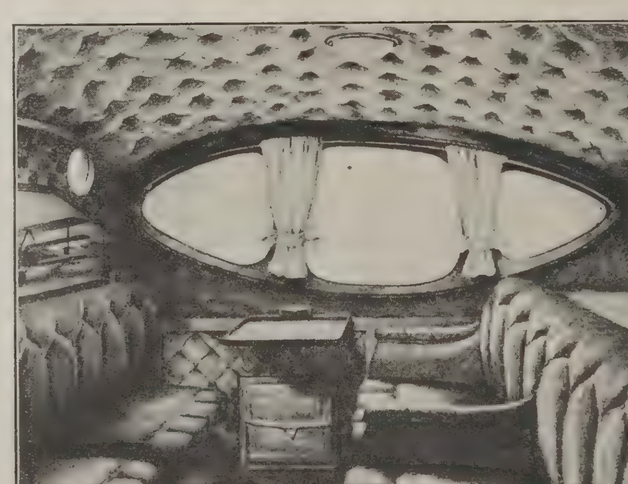


Fig. 6

Fig. 7 shows the type of giant traffic aeroplanes built by the Hawa Co., they are triplanes of the described design. The two engines are mounted at the front end of the two hulls and driving the two propellers independently of each other. The pilot's seat is arranged before the roomy passenger cabin at the junction of the two engine hulls. This arrangement has the advantage that the heaviest and strongest parts of the machine lie in front and at headlong falls principally take up the existing stresses. If the engines are mounted within the wings, as often found, many drawbacks can occur, for example, producing a large moment of inertia around the longitudinal axis, a warping of wings at unfavorable landings, etc. Such Hawa giant machines are built in different sizes.

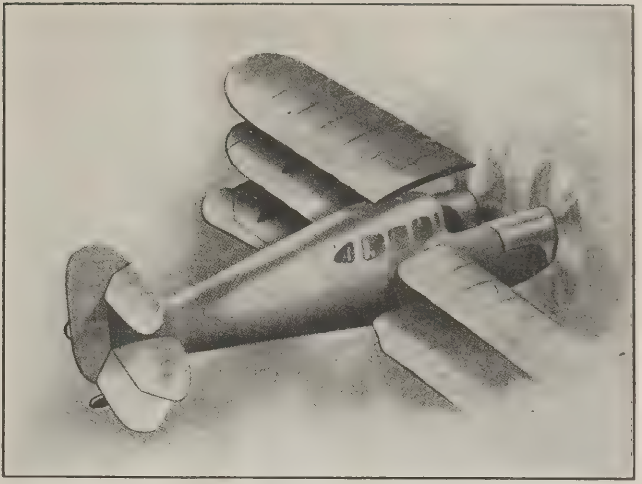


Fig. 7

PERFORMANCE TEST OF JUNKER SL-6 WITH 185 H.P., B.M.W. ENGINE

Official Performance Test—Summary of Results

Aeroplant, Junker S. L-6; No. P-145.
Type, Commercial.
Engine, 185 hp. B. M. W. engine; 243 hp. at 1,445 r. p. m.
Propeller, German make.
Equipped as passenger transportation.

Weight (pounds):

Empty (including water)	2,317
Armament and equipment	None
Crew	655
Gasoline (benzol 50 per cent; gasoline 50 per cent)	569
Oil	64
Weight loaded	3,605

Weight/square foot, 8.64 pounds.
Weight/horse power, 14.8 pounds.
This engine develops 243 hp. at 1,445 r. p. m. run on a mixture of half benzol and half gasoline.

Standard altitude in feet	Climb				Speed		
	Time, in min.	R.p.m.	Rate ft. min.	Flow gal. hr.	M.p.h.	R.p.m.	Flow gal. hr.
0	0	1,365	580	....	111.2	1,445	....
6,500	14.4	1,365	345	....	107.2	1,435	....
10,000	27.3	1,365	215	....	102.5	1,420	....
15,000	....	....	....	....	....	....	....
20,000	....	....	....	....	....	....	....
25,000	....	....	....	....	....	....	....
13,200 service ceiling	48.7	1,360	100	....	95.1	1,395	....
15,900 absolute ceiling	....	1,350	0	....	67	1,350	....

Endurance, full throttle at 10,000 feet (incl. climb), 7 hours 35 minutes.

Minimum speed at sea level (lowest throttle), 52.1 m. p. h.

Pilots' Observations

The flying qualities of the JL-6 all metal monoplane appear new and different when originally flown by pilots familiar with conventional types, but the same general flying principles applying to all aeroplanes govern the flying of the Junker. An exact coordination and proportioning of the amount of the controls is required or the aeroplane will side slip or skid badly. It is extremely sensitive in this respect. The rudder and elevators appear and feel too small.

The aeroplane is spirally unstable due to the large fin area toward the tail causing a lifting of the rear of the fuselage in the event of a side slip.

Until familiar with the aeroplane, pilots invariably use too little bottom rudder in making turns. When stalled, both with power and without, the tendency to spin is easily checked, the aeroplane responding readily to the controls.

The JL-6 takes off very slowly, especially when heavily loaded. The tail does not come up until some distance has been traveled. The visibility for the pilot is not good. One side is almost entirely blind and it is difficult to see over the end of the nose. The fact of flying from one side with the other partially blind has a tendency to cause the pilot to fly with one wing low; a very bad feature in landing. The aeroplane has an exceedingly long and flat glide. The absence of wires gives the erroneous impression of slow speed in the glide.

The pilot must be careful in landing. The JL-6 will suddenly drop a wing when flying speed is lost unless care is used to keep the wings parallel to the ground in the glide. A stall landing is hazardous. The aeroplane has a tendency to ground loop in landing or in taxying in a strong wind. It rolls but a short distance after landing. The landing gear effectively cushions the landing shock.

The position of the controls is unhandy, especially for a pilot of medium stature. The distance from the seat to the pedals is too great to permit of their use in a natural position. Operation of these pedals having one end hinged to floor cramps the ankles and leg muscles. The long reach to the throttle and switch does not permit quick action in emergency. The notched push-rod type of throttle makes delicate use difficult. A standard engine throttle is desirable.

A mixture of one-half gasoline and one-half benzol gives the best engine results.

The radiation surface is ample, even in warm weather. The shutter control is quite inadequate. The oiling system caused no trouble.

The maintenance of this aeroplane is, on the whole, very simple, especially in regard to the engine. The mounting gives easy access to spark plugs, distributors, carburetors, etc. The all-metal construction makes a hangar unnecessary for its protection.

Back firing of the engine tended to ignite and explode gasoline from the carburetor which drained into the fuselage through air intakes having no outlet from the fuselage. Efforts were made, which were apparently successful, to eliminate fire hazard by installing air intake pipes leading from the pan under the crank case to the outside of the airplane below the engine, thus directing back fires from outside the fuselage.

Breakage of dangerous gas lines was prevented by the installation of flexible hose connections. The gas pump was firmly fastened at the bottom.

Holes were cut across the bottom of the fuselage at the bulkhead back of the engine to prevent the collection of gasoline and oil in the fuselage.

Considering the fire hazard eliminated and that the aeroplane is flown only by good pilots familiar with its flying qualities, the JL-6 should be considered as an extremely important development, being very economical and efficient, having a remarkable performance and presenting features of construction having valuable possibilities.

J. A. Macready,
First Lieut., A. S., Test Pilot.
Harold R. Harris,
First Lieut., A. S., Test Pilot.

Distribution of Weights

	Pounds
Weight empty (with water)	2,317
Crew	655
Gasoline	569
Oil	64
Weight loaded	3,605
Weight on front wheels (tail skid on ground)	3,130

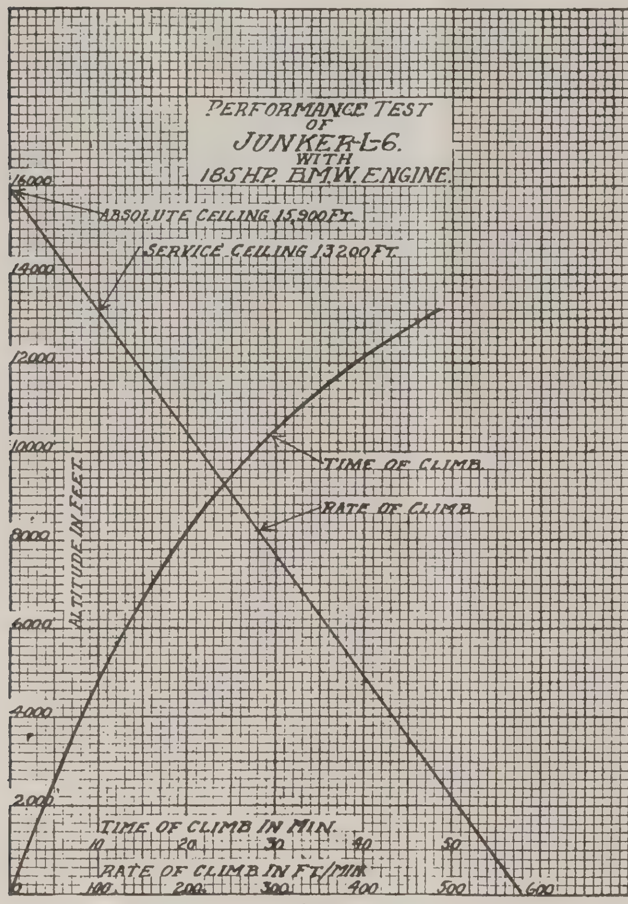


Fig. 1.

Weight on tail skid (tail skid on ground)	475
Weight on front wheels (flying position)	3,252
Weight on tail skid (flying position)	353
Center of gravity (distance from wheels in flying position)	2′ 5/8″

Provision for special equipment not carried during test.

Description of Aeroplane

JL-6 ALL-METAL MONOPLANE.

Dimensions.

Over-all span, 48 feet 8 inches.
Over-all length, 28 feet 9 inches.
Over-all height, 10 feet 0 inches.
At rest, 7 feet 3 inches.

Aerofoils.

Wing curve, Junker.
Sweepback, 16 inches, trailing edge 18½ inches forward.
Dihedral, top 1¼°, bottom 4°.
Total area, including ailerons, 4,174 square feet.
Wing spars, front, 22 feet 1 inch, rear, 21 feet 10 inches.
Root section included, 2 feet 10 inches.

Plane.

Span, 48 feet 8 inches.
Chord, root, 9 feet 10¾ inches, tip, 6 feet 8 inches.
Area, 4,174 square feet.

Ailerons or Flaps.

Number, 2 feet.
Arrangement, trailing edge of wing at extremities.
Length, 11 feet ½ inch.
Chord, 1 foot 5¾ inches, 1 foot 10 inches, 11½ inches.
Area, 16.28 square feet.
Total area, 32.56 square feet.

Center Section.

Area, 101.2 square feet.
Dimensions, 10 feet 3 inches by 9 feet 10½ inches.
Contents, gasoline and floor of cabin tank.

Stabilizer.

Area, 28 square feet.
Setting, negative camber.
Span, 12 feet 3¾ inches.

Elevator.

Area, 20.88 square feet.
Distance from leading edge of elevator to C. G. of aeroplane, 20 feet 7 inches.

Rudder.

Area, 12.5 square feet.
Distance from leading edge of rudder to C. G. of aeroplane, 21 feet 1 inch.

Fuselage.

Maximum cross section shape, rectangular.
Maximum cross section area, 29.4 square feet.
Maximum cross section dimension, 4 feet 7 inches by 6 feet 5 inches.
Distance of maximum section from leading edge, lower plane, approximately 15 inches.

Landing Gear.

Number of wheels, 2.
Tread, 7 feet 4 inches.
Shock-absorbing system, rubber cord.
Braking device, tail skid.
Wheels ahead of C. G., 24 inches approximately.

Fin.

Area, 5 square feet.

Description of Power Plant

Engine.

Make, B. M. W. III A.
Factory No., 2010.
Type, 6-cylinder vertical.
Number in aeroplane, 1.
Location, nose of fuselage.
Rated horsepower, 185 H. P.
Bore, 5.906 inches.
Stroke, 7.086 inches.
Weight dry, 640 pounds.
Gas consumption, 0.458 No./hp. hr.
Oil consumption, 0.0333 No./hp. hr.
Remarks: Engine rated at 185 b. h. p., but develops 198.4 b. h. p. at 1,400 r. p. m. at sea level with aviation gasoline and 233.2 with 50 per cent gasoline and 50 per cent benzol.

Ignition.

Magneto.
Make, Bosch ZH 6.
Number, 2.
Plugs, make, B6.

Carburetors.

Make, special.

Radiators.

Type, nose.
Position, nose of fuselage.
Frontal area, 384 square inches.
Depth, 3⅜ inches.

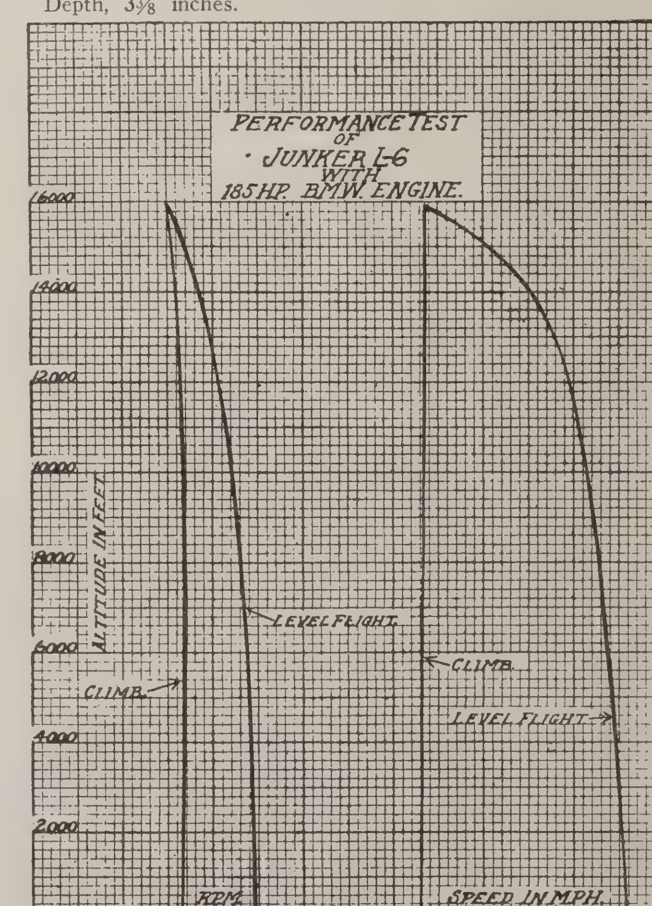


Fig. 2.

Length, 24 inches. Width, 16 inches.

Exhaust Pipes.

Description: Six in one stack leading up and back.

Lubrication.

Capacity oil tank, 8 gallons. Oil used (brand) Mobile B.

Fuel System.

Number of tanks, 3. Location, 2 in wing, 1 in tail.

Motor Control.

Description, push rods.

Propeller.

Make, Reschke. Pitch, 70¾ inches.
Number of blades, 2. Tips, brass.
Diameter, 9.51 feet. Manufacturer's No., 38400.

(*Concluded from page* 32)

of about this power corresponding with certain well-known engines of foreign manufacture, for use in small shipboard and other type aircraft.

250 to 275 H.P. engine: This engine is to be developed for use in a twin-engined aeroplane or seaplane designed as a torpedo carrier, bomber, or spotting machine. It should be noted that the total power of these engines, as contemplated for a twin-engined installation, is approximately equal to that of the 550 H.P. engine noted under class (a), but the development of the smaller engine appears to be desirable from considerations of maneuverability and ease of installation in Naval aircraft designed as torpedo carriers.

650 to 750 H.P. water-cooled engine: The development of a larger type engine for rigid airships appears to be desirable, in view of the increase in size of this type of aircraft, with a view to reducing complication of power plant to the greatest extent practicable without undue concentration of weights, and at present, it appears that 650 to 750 H.P. represents the maximum power and weight that was practicable to concentrate in a single unit for this purpose. To be developed by the Navy Department.

Steam engines: The development of the steam engine is to be continued at once, and worked to a definite conclusion as rapidly as possible.

Geared engines: The Navy is now engaged in the development of the geared engine for use in its aircraft.

It is probable that the development of both air-cooled and water-cooled engines of the power noted will be desirable. It will be seen the continuance of existing development work and the inception of other projects covering an extremely wide field of engines, both as to power and as to type, has been determined upon. Such wide and detailed development is extremely necessary at this time in order that the availability, or lack of engines of a given type, may not prevent the development of types of aircraft of the greatest utility.

The importance and possible value of the development of our internal combustion engine of turbine type is being followed by the War and Navy Departments and there are some indications that increased progress in aeronautics will warrant its further development in the near future.

THE HANDLEY PAGE WING

By F. HANDLEY PAGE*

THE present paper is a record of experimental work carried out with a view to overcoming the phenomenon of "burbling." As is well known, the total pressure on an aerofoil is the sum of the positive pressure on the underside and the negative suction on the upper. If this negative suction can be made to increase progressively with increasing angle of incidence to angles greater than heretofore, the maximum value of the aerofoil lift coefficient will be increased. The effect of such an increase on aeroplane design depends upon the magnitude of the increase and the extra structure weight of the device necessary to obtain it. The present method which is now described has been evolved from experimental data, and an outline of the results is given below.

In a paper which I read before the Royal Aeronautical Society in April, 1911—ten years ago—I attempted an analysis of the somewhat meagre results then available on the pressures on plane and curved surfaces moving through the air. The effect now known as "burbling" was referred to as follows:

"To obtain a law giving the normal pressure on a plane as a continuous function of the angle of incidence of the impinging air from 0 to 90 is impossible owing to the two distinct forms of flow that occur on the back of the plane. From the horizontal position of the plane up to an angle varying in magnitude from 10° to 50° depending on the aspect ratio, shape and curvature of the plane, the air hugs the back of the plane, the suction due to the rushing air is felt directly on the back of the plane, and the pressure increases continuously as some function of the angle. At angles greater than this critical value the air leaves the back of the plane, a 'dead' air region is formed there, and any reduced pressure or suction on the plane back tending to increase the total 'lift' is then solely due to the drag of the 'live' air stream at the edges of this 'dead' air region."†

A further reference was made later on in the paper:‡

"The critical angle at which the 'live' air leaves the plane back is reached earlier in the case of planes of high aspect ratio, and the latter accordingly do not have such high maximum values as the planes of lower aspect ratio.

"With planes of high aspect ratio there is not the same facility for the 'feeding in' of fresh air at the plane sides to act as a link between the plane and 'live stream,' and therefore the 'live stream' leaves the plane back at an earlier stage than in the case of the plane of lower aspect ratio."

In Fig. 1 is the set of curves reproduced from the 1911 paper, showing the pressure on aerofoil as a function of the angle of incidence. It will be observed that the square aerofoil marked P.1:1 continues lifting until 40°, whereas the aerofoil of aspect ratio 6.25:1 (marked L.6.25:1) "burbles" between 10° and 15°. If, then, it were possible to convert the high aspect ratio aerofoil into a series of square ones and maintain the same conditions as in a square plane, higher maximum lift coefficients should be obtained.

Fig. 2 is an aerofoil of aspect ratio 6¼ converted into six square planes by five slots, each parallel to the chord of the plane. With the slots open the total "lift" on the plane was slightly increased and the "burble" took place at 14° instead of 13° (*see* Fig. 3).

Improved results were later obtained with this form of slot, but this line of investigation was abandoned in favor of a transverse slot (*see* Fig. 4), which was tested on an aerofoil of R.A.F./15 section (*see* Fig. 5). The shape of the slot, the width of the two openings and the position of the forward small aerofoil, and many other details, were found to have a very marked effect upon the results.

Fig. 6 shows some early type slots on a R.A.F./6 section, and Fig. 7 the results obtained. The lift coefficient increases about 25 per cent. with the slot opened. Further developments are shown in Fig. 8, where a simple single slot is formed by the swivelling front edge on aerofoil No. 32, which was approximately of R.A.F./6 cross-section. This aerofoil was tested at the National Physical Laboratory at a speed of 80 ft. per second, and the results are shown in Figs. 9 and 10. The maximum lift coefficient of the plane with the slot closed was .633 and with the slot open .943, an increase of 50 per cent. The maximum value of the lift/drag coefficient was 16.6 and 14. respectively.

These results have also been plotted in Fig. 10 on curves showing the relation between speed and horse-power per lb. weight, according to the method described in a paper which I read before the Aeronautical Society in March, 1917. Speed is plotted as $\frac{1}{\sqrt{ky}}$, and horsepower per lb. weight as $\frac{kx}{ky\sqrt{ky}}$. With the slot open there is a reduction in landing speed of about 20 per cent., and with the slot closed practically all the advantages of the ordinary section.

So far the tests described have been on one particular kind of section, and further experimental work has been carried out showing that similar results may be obtained with any type of section, both on what may be termed a "high speed" section, such as R.A.F./15, or a "high lift" section, such as R.A.F./19. Fig. 11 shows the R.A.F./15 section—51*a* and 51*b*—the section with the slot closed and the underside gap filled up being with a R.A.F./15. There is a slight difference between the two, 51*a* having the leading edge of the aft main aerofoil with a slight Phillips entry, whereas 51*b* has the leading edge of the aft aerofoil on the chord line. The results are plotted in Fig. 12, showing a slight improvement in lift in favor of 51*b*.

---

* Paper read before the Royal Aeronautical Society.

† "The Pressures on Plane and Curved Surfaces Moving Through the Air," *Aeronautical Society of Great Britain Journal,* April, 1911, p. 48.

‡ "The Pressures on Plane and Curved Surfaces Moving Through the Air," *Aeronautical Society of Great Britain Journal,* April, 1911, pp. 55 and 56.

A comparison between the R.A.F./15 and this section with the slots open is also given on the curves. The maximum lift coefficient is increased from .52 to .84, an increase of 61 per cent, and the lift/drag ratio is higher with the slot open at all angles above 12°.

The same general type of results were obtained with a thick section, such as R.A.F./19, a section of which is shown in Fig. 13 with and without the slot, this aerofoil being No. 44. As, however, the R.A.F./19 is a section of small lift/drag ratio, the results of the single slot have not been included in this paper.

An investigation of pressure distribution on the main and auxiliary aerofoils formed by the slot showed that the results obtained were of the same character as in an ordinary aerofoil, and that "burbling" would take place on the small auxiliary aerofoil when it was at its critical angle, just as an ordinary aerofoil would do without a slot. It is evident that this can be overcome by further slots extending throughout the plane, and a series of experiments was accordingly carried out with various sections, to determine the lift that would be obtained with a multiplicity of slots. In Figs. 14, 15 and 16 the R.A.F./19 is shown with two, three and seven slots, and a series of experiments was conducted with each number of slots from one to seven.

(To be continued)

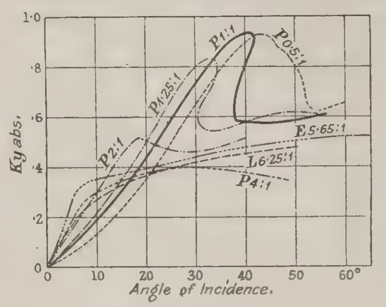
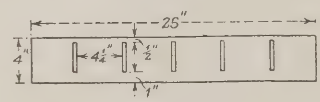


FIG. 1



H.P 20 Aerofoil 5 Slots
FIG. 2

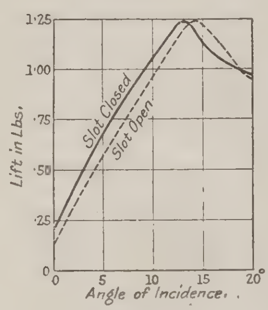
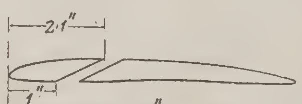


FIG 3



Plane Section with early type slot
FIG 4

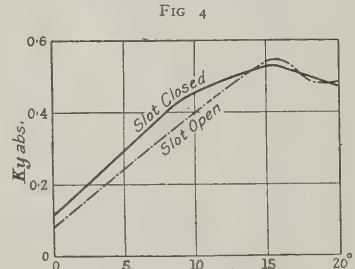
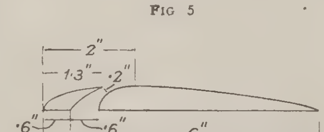
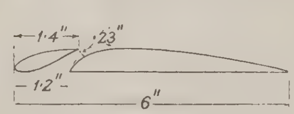


FIG 5



R.A.F. 6 Section with Early Type Slot.



Same Section with Later Type Slot.
FIG. 6

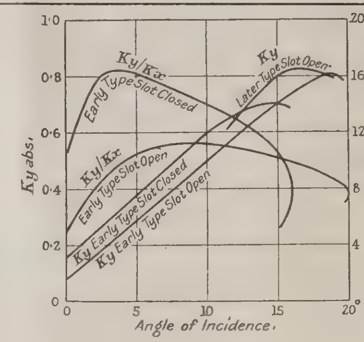
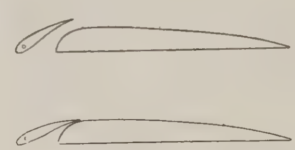


FIG 7



Slotted Aerofoil No. 32, 36"×6"
FIG. 8

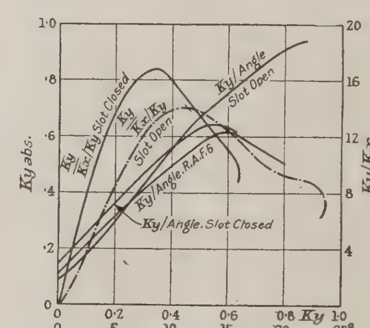


FIG. 9

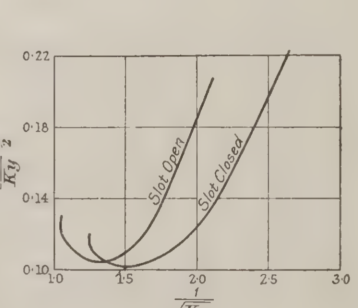


FIG 10

Slotted Aerofoil 51a. 36"x6"

Slotted Aerofoil 51b. 36"x6"
FIG. 11

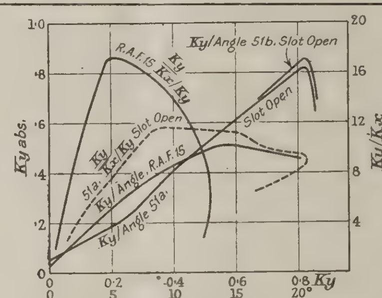


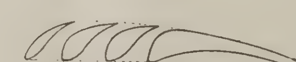
FIG. 12

R.A.F. 19 Section (a). No Slot.
36"x6"

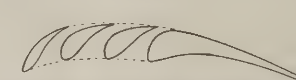
R.A.F. 19 Section (b). 1 Slot. Aerofoil No. 44 A.
36"x6"
FIG. 13

R.A.F. 19 Section. 2 Slots. Aerofoil No. 44 C.
36"x6"

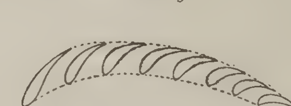
R.A.F. 19 Section. 2 Slots. Aerofoil No. 44 D.
36"x6"
FIG. 14



R.A.F. 19 Section. 3 Slots. Aerofoil No. 44 F.
36"x6"



R.A.F. 19 Section. 3 Slots. Aerofoil No. 44 L.
36"x6"
FIG. 15



R.A.F., 19 Section, 7 Slots, Aerofoil 53J, 36"×6"
FIG. 16

R.A.F., 19, 7 Slots, Aerofoil 53J, 36"×6", Angle of maximum lift
FIG. 16A

NAVAL and MILITARY AERONAUTICS

General Mitchell on Charting the Air

Charting of the air is essential to the national defence of the United States, Brig.-Gen. William Mitchell, Assistant Chief of the Army Air Service contends.

General Mitchell declared that the "laying of the cornerstone" in Washington recently of America's first "Airway," from Washington to Dayton, will prove to be a "vital milestone in the progress and development of both commercial and military aeronautics."

"The limitless and boundless ocean of the air," Gen. Mitchell said, "must be explored and charted just as unknown lands and oceans, so that navigators may with ease make their way without loss of time or danger across vast expanses of territory in peace or war.

"The establishment of well organized air routes throughout the country, especially in America, is as essential to a well balanced system of national defence as is the development work on the aircraft itself.

"The installation of an airway entails the location of landing fields with all accessories, including radio direction finding, radio communication, aids to night navigation, housing and maintenance of equipment. It is undoubtedly true that with properly established airways of this kind cross-country flying, night or day, in good or bad weather, will be safer than auto touring by road, and, with the development and perfection of the machine itself will in time surpass in speed, comfort, and safety the modern comforts of transports.

"These air routes will provide a network whereon the units of the National Guard and the organized reserve of the army can be placed. However, these highways of the air will not be usurped by the Air Service, but they will be open, under legislative restrictions, to all commercial operators, who will receive all the benefits and conveniences of such an organization; therefore commercial aeronautic interests will be fostered.

"The Model Airway, between Washington and Dayton, will become then the first unit in a systematic route of airways throughout the United States which will be started under a policy formulated by the Army Air Service and which will be guided in its organization by the experience gained from the establishment of an operation of the Model Airway.

"The Model Airway as chosen is extremely well suited to the purpose of serving as a basic guide in this expansion program. Almost all of the natural problems attendant to successful air navigation are met on this airway, which is one that will always be needed. Incidentally, it connects Washington with the Air Service Engineering Division Headquarters. In the course of this route appear mountains to be passed over, varying climatic conditions and terrain of almost every type and character."

Increased Activity at Pacific Air Station

San Diego.—The assembly of the thirty-three new planes which have recently arrived, together with the regular schedule, is keeping the station personnel busier than usual.

Of the new aeroplanes which are now being put into shape for flying, 16 are De Havilands, eight are Loenings and nine are Voughts.

Spring battle practice is drawing nearer every day, and the officers and enlisted men of the station have not only the problem of getting the newly arrived planes into flying condition, but all of the older machines must be thoroughly gone over for repairs and replacements. Recent announcement that the twelve planes which made the Balboa flight will not return will mean that there will be a large percentage of new planes on this station.

A pony blimp, the property of the Marshall-Neilan Motion Picture Corporation, of Los Angeles, visited this station with three persons in the car. The blimp was "parked" in our big hangar overnight and left early next morning to return to Los Angeles.

Mather Field News

Under plans which have been approved at Washington, Mather Field will become the largest Air Service Garrison in the Western Department of the Army, with five air squadrons and approximately 1,000 men, it was stated unofficially at the field recently.

Arrangements to increase the force are being made by Army recruiting authorities, and the War Department has authorized an immediate increase of 585 men in the Air Service and about 40 men in other branches. Mather Field is the forest fire protection center for the forests of all Western States.

Carlstrom Field News

Several transfers have been made on the post, Lieut. Camblin having gone to Kelly Field for pursuit work; Capt. Mileau to Post Field; Lieut. Ennis and Lieut. Castor will go to the Philippines, and Lieut. Guy Kirksey to Langley Field.

France Field News

An interested visitor at the field recently was Brig. Gen. Henry A. Reed, retired, seventy-six years old, who was given an ocean to ocean flight over the canal by Lieut. Chandler. General Reed is a veteran of the Civil War, having been a 1st Lieutenant, in command of a company at the close. After the war he entered West Point and was commissioned a 2nd Lieutenant in 1870. He had to serve twenty-eight years before he reached the rank of Captain, promotions being so slow in those days, and again commanded a company.

First Pursuit Group Participates in Protection Patrol

The following squadrons of the Pursuit Group furnished five planes each for the protective patrol on January 14, 1921:

27th Aero Squadron: Formation left ground at 1:40 P.M., leader of formation, Second Lieutenant George P. Tourtellot, Air Service. The second five-plane formation from the 95th Aero Squadron joined in echelon at 2,000 feet at about 2:05 P.M., climbed to an altitude of 6,000 feet and proceeded to Somerset, Tex.; flew about in that vicinity waiting for the DH4B formation. Two planes dropped out of the 95th formation at 2:25 P.M. and started for the aerodrome. Met DH formation at 2:35 P.M., at an altitude of 7,000 feet. Flew as protective patrol to Devine, Tex. Mission was accomplished. DH formation returned to aerodrome, breaking up over it at 6,000 feet, landed at the aerodrome at 3:30 P.M.

94th Aero Squadron: Formation left ground at 1:40 P.M., leader of formation, First Lieutenant Samuel G. Frierson, Air Service. Flew over Von Ormy, Texas, at 2:00 P.M., at an altitude of 6,000 feet, picked up Bombardment Formation of 5 DH4B's. Protected formation to Lytle, Texas; bombed Lytle at 2:14 P.M.. 147th Patrol joined at 2:16 P.M. at 6,000 feet. No enemy aeroplanes observed. Train movement normal. No troop movement. Large fires southeast of Von Ormy, Texas, about 20 miles. Returned 2:30 P.M.

95th Aero Squadron: Formation left ground at 1:55 P.M., leader of formation, 2nd Lieutenant Lloyd C. Blackburn, Air Service, met 27th Formation over Lady of the Lake, Texas, at 2:00 P.M., proceeded to Somerset, Texas. Stayed in vicinity of Somerset for ten minutes, when bombing formation arrived at 2:35 P. M. Took position on left about 1,000 to rear and 500 to 1,000 feet above bombing squadron. Maintained this position until breaking up of formation. No. 2 dropped out at Somerset due to missing motor. No. 5 dropped out a few minutes later due to motor overheating and lack of water. Returned to airdrome at 3.30 P.M.

147th Aero Squadron: Formation left ground at 1:50 P.M., leader of formation, 2nd Lieutenant Hiram W. Sheridan, Jr., Air Service; flew over Von Ormy, Texas, at an altitude of 6,500 feet. Picked up Bombardment Formation and 94th Patrol at about 2:15 P.M., east of Lytle, Texas, heading northeast, following these formations to airdrome and continued formation for instructon purpose. Landed at 3:50 P.M.

Personal Pars

Major E. L. Canady has been assigned to Langley Field.

Major B. Q. Jones goes to Manila.

Capt. T. Boland has been transferred to Little Rock air intermediate depot, Ark.

Capt. H. W. Flickinger has been assigned to Panama.

Lieut. H. R. Harris of McCook Field has been decorated Chevalier, Order of the Crown of Italy, by the Italian Government. Information to this effect was received by Lieutenant Harris recently. He served with the A. E. F. in Italy for a year during the world war.

H. N. Schofield, formerly Lieutenant, is Western representative of the Auto Motive Tractor Corporation of America, his address being National City, Cal.

Robertson Griswold, formerly Captain, is with the Maryland Trust Co., Baltimore, Md.

FOREIGN NEWS

New Company in Sweden

In Stockholm recently, a new commercial aviation company was registered under the name of Nordiska Luftredeni Aktiebolaget. It has a capital of 150,000 kroner, of which 87,000 has already been subscribed.

Two British machines have been purchased and others are expected to arrive shortly.

It is the intention of this company to run an inland air-line.

French Air Services

French aeroplanes engaged in commercial service traversed a distance of nearly 1,200,000 miles during 1919 and 1920 and carried 6,697 passengers and 155 tons of mail, Col. Saconney, Director of Aerial Service, declared recently to members of a committee from the French Senate.

Seven lines are in operation, and it is expected that normal schedules will be maintained soon between Paris, Warsaw, Geneva, London, Brussels and Cabourg. Regular service will be established between Paris and Bayonne, Bilbao, Spain, Toulouse and Casablanca, Morocco, during 1921.

Civil Flying Progress in Britain

Since the opening of Civil Aviation in May 1919, British aircraft have flown considerably more than a million and a half miles, the approximate figures to the end of last year being 1,556,000. For the quarter ending December 1920, the number of miles was 175,000 as compared with 138,000 in the same quarter of 1919, although the number of flights was considerably less. The number of flights reported since May 1919 was 62,003.

The total number of passengers carried to December 31st was 106,712, the figures for the last quarter being 6,427, a slight increase over the number of 6,284 for the same period in the previous year.

Goods carried, almost entirely on Continental services, weighed 167 tons, the weight for the last quarter being 34½ tons, which is a substantial increase over the figure for that quarter in 1919 and is considerably above the average quarterly weight throughout.

There were three accidents to machines during the quarter, one of these only with fatal results. For the whole period under review, the number of accidents was 48, but of these 20 did not involve injury to personnel. The number of machine miles flown per flying accident is 33,100. The rate of passengers killed per thousand carried was .10 and for passengers injured .15.

Aerial Observation for the Navy

A British Admiralty order states that the development of gunnery in the future depends to a large extent on the efficiency of observation from the air. With this in view the Admiralty invite applications from lieutenants of 1918 seniority and upwards for training as observers. Officers selected will be lent to the Royal Air Force for training at one of the R. A. F. establishments. While under training they will receive full pay of their naval rank, with extra remuneration as laid down for officers under training. After qualifying, these officers will be eligible for appointment as observers in aircraft-carriers in the Royal Navy, and when actually detailed for such work will receive the allowances for qualified officers. It is anticipated that the course will not occupy more than four to five months, and during that time officers will retain their rank and wear naval uniform.

International Seaplane Race

The Royal Aero Club has decided to contribute £1,000 towards the expenses of the British competitors in the International Seaplane Competition for the Jacques Schneider Trophy to be held at Venice in September.

Parachute Demonstration

In amplification of his lecture on "Parachutes" before the Cambridge University Aeronautical Society, Maj. T. Orde Lees, O. B. E., A. F. C., gave a demonstration of the "Guardian Angel" parachute on the Society's landing-ground at Girton. Before about 300 members and friends who inspected the attachments of the parachute, and some 5,000 spectators, two jumps were made from a De. H. 9.

Aerial Ambulance

At the Brooklands works of Vickers Ltd. a commercial "Vimy" has been re-designed and modified for ambulance work. The interior of the fuselage has been fitted up with stretchers and appliances for the conveyance of injured people. The engine mountings have been altered to accommodate two 450-h. p. Napier "Lion" engines, which are placed more forward and lower than is usual in the "Vimy."

First British All-Metal Machine Bought by Air Ministry

The Short "Silver Streak" which was exhibited at the last Olympia Aero Show has been purchased by the Air Ministry and was flown by the makers' pilot to Farnborough. An average speed of 125 m.p.h. was maintained on the delivery trip.

The "Silver Streak" is the first all-metal aeroplane of British construction which has flown successfully.

It is understood that no further flying is to take place upon this machine, it being the intention to submit it to detailed tests to destruction of the strength of the structure.

A New Siemens-Schuckert

With a passenger capacity of 24, a monster aeroplane, with four 600 h. p. motors, is reported to be in the making at the Siemens-Schuckert works in Germany.

Fees at Berlin Aerodrome (Johannisthal)

According to the German Press, the following are the fees for aircraft using the Johannisthal aerodrome:—

1. Landing, 50 M.; Starting, 50 M.
2. Assistance:
   (*a*) Personnel, including use of tools: At prevailing local rates with 100 per cent. increase for general expenses, and 50 per cent. for workshop expenses.
   (*b*) Supply of material: Current prices with increase of 50 per cent.
   (*c*) Supply of fuel, including filling up: 2 M. per kilo increase on the cost price.
3. Housing:
   (*a*) Up to 24 hours, 40 M. per day.
   (*b*) In excess of 24 hours, 40 M. per day.
   (*c*) Monthly hire, 800 M.

Algiers Activity

A promising undertaking is in course of materializing in connection with the creation of a commercial aircraft base at Maison Blanche, about 11 miles from Algiers. A company has acquired there 130 hectares of land for the purpose, and it is stated, that a sum of 43 million francs has been provided for laying out the landing-ground, hangars, buildings, etc. By way of a start, two of the Zeppelins surrendered by Germany are said to have been ceded to this company, and are to proceed to the aerodrome under their own power.

Brazil Encourages Aviation

For the purpose of encouraging aviation in Brazil, the customs tariffs have been revised by a special commission, and, subject to being formally passed by the Chamber, provide that during the first three years at least of this law the importation of aeroplanes, airships and other aircraft, engines, machinery, hangars and accessories, are to be free of dues and other customs duties when the above-mentioned articles are intended for schools, camps, aerodromes, national or international aviation competitions in Brazil. In addition, transport companies will receive the same exemption provided that they are founded and worked in Brazilian territory.

Aircraft for the Dutch Indies

The Dutch Colonial Department has ordered a number of D.VII machines from the Fokker factory for use in the Dutch Indies. These machines are fitted with British engines and have been specially constructed for use in the damp, warm climate of the Dutch Indies.

Belgian Congo Air Service

Reports from Brussels state that the first results of the air service established in Belgian Congo are proving satisfactory. Seven pilots completed the journey between Kinshassa and Gombe, the waterplanes putting up 130 k.p.h. The air route is arranged in three stages; Kinshassa-Ngombe, Ngombe-Lisala, Lisala-Stanleyville. This journey by boat takes 18 days upstream and 12 days on the return trip.

Australia Creates an Air Council

An Air Council and subordinate Air Board have been created to control aviation in Australia. The personnel of the Air Force will be used very largely for surveying, map-making and doing the necessary pioneering work in arranging air routes in Australia.

Successful Trial of R.80

On February 9 speed trials took place from Messrs. Vickers' Barrow works of "R.80." The work of getting her out of the shed was safely carried out in two minutes, following which there was an hour's halt for engine testing before she finally got away on her trials.

With two aft engines working she was headed away towards Cumberland, and then the big forward engine was started. She rose slowly, steering towards Black Combe, but turned out towards the Irish Sea, and after a short run level with the land she circled round to Barrow, and, making a higher altitude, her speed increased greatly, and she raced away inland. A trip was taken towards Morecambe Bay and out to sea. A series of smart runs was then made over land and sea. Finally, after making a circle of Furness, she returned to her hangar.

Messrs. Vickers have produced in R.80 a ship of only 1,250,000 cubic feet capacity that will give a performance in speed and endurance equal to that of R.33 and R.34, which had a capacity of 2,000,000 cubic feet.

The overall length of the vessel is 530 ft.; its diameter is 70 ft.; and height 85 ft. The total gross lift is approximately 38.5 tons under normal atmospheric conditions, when the airship is at sea level, and the disposable lift—that is, the amount available for carrying fuel and oil, water ballast, crew and passengers, or other useful load—is about 17 tons.

She has a full-speed radius of 4,000 miles, while at a cruising speed of 50 miles per hour she should be able to fly 6,500 miles.

France May Control Zeppelin Factory

It is reported that negotiations are in progress with a French Company to acquire a controlling interest in the Zeppelingesellschaft.

The overtures, however, are still in the preliminary stage.

The Coupe Michelin for Aircraft

In response to a query raised by the Aero Club of Italy, the Aé.C. de France announces that the competition is open equally for waterplanes. These in their class will be entitled to compete in any of the countries in the Federation. Each country has therefore to arrange for both land and water machines to compete over their respective elements over a 3,000 kilometre course, with a minimum number of fifteen alightings, the essence of this "commercial" machine contest being the best speed over the 3,000 kilometres.

Professional Parachutistes

Two French ladies have taken up parachute descents as a profession, Madame de Nuzières with the "Guardian Angel," and Mlle. Reneó Jacquart with a Jean Ors apparatus.

France Acquires Valuable Concessions

According to a Paris report, the Hungarian Government have granted a postal monopoly to France over the territory for an air line which is to be run between Paris, Strasbourg, Prague, Vienna, Budapest, Belgrade, Belgrade and Constantinople. The Hungarian Government have undertaken to instal landing facilities at Budapest, and the air line will be run by the Franco-Rumanian Company which already controls the Paris-Strasbourg-Prague-Warsaw air line. M. de Fleurieu, who had considerable war experience of air matters, and is the moving spirit in this enterprise, hopes also to conclude similar arrangements with the Austrian and Serbian Governments, he having already obtained similar concessions from the Rumanian, Turkish and Czecho-Slovakian authorities. Although the full programme will not be working until 1922, the scheme will be partly in operation before the end of 1921.

ELEMENTARY AERONAUTICS *and* MODEL NOTES

A Flying Model of the Orenco Fighter

(Continued from March 14 issue)

BEFORE actually starting construction of the model, all the necessary material should be obtained so that there will be no interruption in the work. A general list of materials needed is given below, but in addition to this, the builder should have a supply of small nails, glue or Amberoid cement, silk thread and the usual light tools and equipment.

Some of the parts, such as propeller hanger, propeller bearing, propeller, landing wheels, axle, etc., can be purchasd ready made at the model supply companies, but if the builder has the time and patience to make up these parts himself, they are more likely to meet the specific requirements of this model. It will be an advantage to carefully note the outlines given in the drawing last week, and verify the kinds and amounts of materials required, as suggested in the following list, which makes ample allowance for waste due to cutting odd lengths.

Material List

Spruce, 3/8″ x 3/16″ (front wing beams) ....6′-0″
Spruce, 1/4″ x 3/16″ (rear wing beams)..............6′-0″
Spruce, 1/4″ x 3/16″ (motor frame).......................14″
Spruce, 1/8″ square (fuselage and tail)..............6′-0″
Reed, 3/32″ round (wing and tail outlines).........12′-0″
Reed, 1/8″ round (struts, landing gear)..............4′-0″
White Pine, 3/4″ x 1″ (propeller)........................9 1/2″
Steel rod axle, threaded with nuts..........................6″
Wheels, (2)—(landing gear) diameter.................1 3/8″
Rubber strands, 1/8″ flat—(motor)....................25′-0″
Covering, Japan silk or silk paper, (for surfaces).....1 sq. yd.
Bamboo varnish, (for doping the covering)..........4 ounces
Bamboo, 1/16″ x 1/4″ flat (ribs)............................12′
Propeller bearing, plain or ball bearing type.
Propeller hanger, aluminum strip 1/16″.

Light gage steel wire may be included in the list if it is desired to put in all the wing wiring, but the structure should be strong enough to make its use necessary only for the sake of appearances.

Wings

Wings are built up of spruce spars, bamboo ribs and reed edges. Trim the 1/4″ bamboo until about 1/32″ thick and form to wing curves shown on the drawing. To facilitate arriving at the correct curvature, make a solid rib or template about 1/4″ thick and tack it to a heavy board. Steam the bamboo ribs and bend each one until it conforms to the template outline. Then it can be split into three parts, making the finished ribs about 3/32″ wide. In this way three ribs are made at each bending operation.

Ribs are spaced about 1 1/2″ apart along the spars.

Where the interplane struts occur, 1/8″ blocks securely glued to the spar will eliminate the weakening effect due to the 1/8″ holes drilled in them. These blocks should be located at the center-section struts also, although not shown on the drawing.

Ailerons are not desirable for a flying model, but their inner ends may be indicated 7 1/2″ from the tips of upper wings.

The upper wing should be continuous. The lower wing beams can be run through the body, above the lower longerons, to give the strength of an unbroken spar.

Body

The frame work of the fuselage consists of 1/8″ square longerons and 1/8″ square cross-struts, nailed and glued in place. The longerons may be tapered slightly, aft of the pilot's seat, for lightness in the rear portion of the machine is very essential. Cross-struts may be trimmed down a little to save weight.

The motor-stick, with its hook and bearing attached should be secured at the front of the body, and to an extra cross-strut in back of the seat opening. Allow the rear of the motor-stick to be unsupported, for the twisting of the rubber strands causes a corresponding twist of the motor-stick; this, in turn, would make the tail twist if it were rigid with the rear of the body.

From the pilot's seat forward, the top deck may be of light gage aluminum, or can be built up on formers and covered like the rest of the body.

For the radiator, engine cylinders and pilot's head-rest, balsa wood gives a good effect without adding much to the weight. Balsa may also be used to cover in the tail skid mounting.

Tail skid can be made shock-absorbing, as shown on the drawing, but care must again be observed to make the details very light in weight.

The chassis is made of 1/8″ round reed. Axle and wheels of conventional type. Bind the axle to the chassis with small rubber bands to obtain the shock-absorbing effect. A spacer 1/8″ reed from one side of the chassis to the other, in front of the axle, will keep the V's properly spaced.

Tail Surfaces

All surfaces for the tail are flat. Use 3/32″ reed for the outlines, 1/8″ spruce for the main beams and rudder post. The surfaces are not movable, but are fixed straight with the line of flight. The fin and rudder are made continuous; stabilizer and elevator continuous also. The builder will understand that this departure from correct practice is made necessary by the importance of having tail parts of very little weight.

General Notes

Amberoid cement, well applied, will make neat, light joints and its use is preferable to hot glue. The propeller may be fairly heavy to assist in bringing the balance of the finished model well forward, as indicated by the arrow on the drawing. The center of gravity should come 2 1/4″ in back of the upper wing leading edge. The relation of the upper wing to the lower wing must be carefully adhered to if suitable balance is to be obtained. If the C. G. (center of gravity) is too far back, the model will rise too quickly and then dive down; on the other hand, if the weights are forward of the indicated center of gravity (a condition which is rather unlikely, due to the greater quantity of rubber elastic to the rear of the C. G.) the model cannot rise at all. Make all balance adjustments with about twelve strands of rubber on the motor stick. Add to this quantity as necessary to reach the amount required for flying speed.

Another adjustment that must be carefully made is to give both wings a slight incidence angle. The front wing beam should be so located on the model that it is about 3/16″ higher than the rear beam. Make certain that both wings have the same adjustment and that they are lined up true and even.

Some hints on construction and general rules to follow have been given in previous descriptions of flying models in these columns. It will help the builder if he will make notes of the principles applicable to this model and other types of flying models, for many of the conditions apply as well to full sized aeroplanes.

Scale Models Built by Aerial Age Readers

Rupert Sims, of Santa Anna, Texas, has completed a balsa wood model of the Verville-Packard aeroplane described in AERIAL AGE. It weighs just eight ounces complete. Mr. Sims has also built a model of the Curtiss JN-4 and is now engaged in building a model of the Loening monoplane.

Elmer Drummond, of South Pasadena, Cal., has built several models from the three-view drawings of real aeroplanes which have appeared in AERIAL AGE. From these drawings he is reproducing twelve machines in miniature.

Lecture by R. C. Hansen on Model Propellers

A paper prepared by Mr. R. C. Hansen, recently read before the members of the Pacific Model Aero Club, met with such general approval that it was sent to the Club's northern branch, the Portland Model Club, where it was duly appreciated. The information imparted in the article was based upno a series of experiments conducted by the author, assisted by Preston Hapkins, Daniel Tuthill and Huebert Burgess, members of the Club.

Owing to the length of the report, space here is available for only a brief summary of its contents, as follows:

"For a hand-launched long-distance model, a swept-back wing appears most suitable. Experience has brought out the fact that in figuring the diameters of the propellers, the sum of both the propeller diameters should be from one to five inches less than the mean span of the main plane, where the chord is from 5 1/2″ to 6 1/2″.

"A model 36″ long with 21″ span and 5 1/2″ chord can take 10″ propellers carved from blanks 1″ or 1 1/4″ thick. These propellers require 10 strands of 1/8″ flat rubber. Models of this type have flown over 3,000 feet in P. M. A. C. contests; they usually climb rapidly to high altitudes."

Things We Want to Know

(To be sung to the air of "An Ode to Tobacco.")

Why does an aeroplane
Always come down again?
Why cannot it remain
Up where you take it?
If you come down a smack,
Landing upon your back
With a resounding crack,
Why does it break it?

Why does wind ever blow?
Why does snow ever snow?
Why cannot weather go—
Go—well, to blazes?
Why isn't all sky blue?
What ever can one do
When one runs slick into
Thick mists and hazes?

Why can't one hit the sky?
Why does an airman die
When he gets up too high?
Where does he then go? (!)
Why is the air so rough?
Is flying good enough?
What made me write this stuff?
I'm blowed if I know!

E. W. Scott.

Aeronitis Editor:—

Sweet Sir:

I am sending, in response to an urgent call for nonsense, some of the aforesaid material. Hoping this will answer all purposes, I am,

Lovingly yours,

Augustine X. Applesauce.

Neither pigeon toes nor flat feet prevent a person from learning to fly—and a cure is being tested for cold feet.

Illustrated War Phrases.

While rushing the erection of our plane to meet an engagement, our valued scarf pin was caught on a wire drawn out and eluded our search in the grass. We were bemoaning our loss when an agricultural onlooker remarked: "It's a pity you all lost yer pin, caise thur aint no five cent store in this town."

Safe, if not Sane

Pilot—"He's wandering in his mind."

Mechanic—"That's all right, he won't go far."

—*Virginia Reel.*

Lieut.—Well, I guess I'll kiss you good-by until tomorrow.

She—No, George, I couldn't hold my breath that long, and besides I must go inside in ten minutes.—*Banter.*

Editor—We can't accept this poem. It isn't verse at all; merely an escape of gas.

Aspiring Poet—Ah, I see; something wrong with the meter. —*Medley.*

Lieut.—What's a divorce suit?

2nd Lieut.—Opposite of union suit.—*Purple Cow.*

Sympathy

"Willie," said his mother, "I must insist that you stop shooting craps—those poor little things have just as much right to live as you have."—*Gargoyle.*

Professor (telling the story of how Orpheus descended into the lower regions to get Eurydice, his wife)—You understand the allusion, of course; Orpheus went down to Hades to find out where in hell his wife was.—*Tiger.*

"Who was Diana?"

"Diana was the goddess of the chase."

"I suppose that's why she always has her picture taken in a track suit."—*Juggler.*

At Ground School

1—"Well, I surely knocked 'em cold in my courses."

2—"Yeah, whatja get?"

1—"ZERO."—*Scalper.*

In the Summer

She—Gee, it's hot; I believe I'll take off my coat.

He—I'll follow suit.

She—I think your coat will do.—*Scalper.*

At San Diego

I see her on the beach.
Her beauty my eyesight dims.
She surely is a peach—
She has such pretty arms!

She (gushingly)—"Don't you think that talkative women are most popular?'

Lieut. (wearily)—"What other kind are there?"

Tinkle-tinkle went the sleigh bells.

"Oh, listen to Santa Claus on the roof," said papa.

"Where'd you get it, dad?" asked little Sally.

Clarice—"Do you approve of the Volstead Act?"

Lieut.—"Well,—er—no. I never enjoy vaudeville."

Lieut.—"What did you think of the Turkish atrocities?"

Mechanic—"I don't know; I never smoked them."

Bet It's a Phony One

"Will you be in tonight if I give you a ring?"

"Oh, George! I'd stay in for *anyone* with those intentions." —*Widow.*

"Yes, Marietta, my description of a mean man is one who takes his girl on a joy-ride, promises not to kiss her—then keeps his promise."—*Orange Peel.*

AERIAL AGE WEEKLY

OL. 13, No. 3 MARCH 28, 1921 10 CENTS A COPY

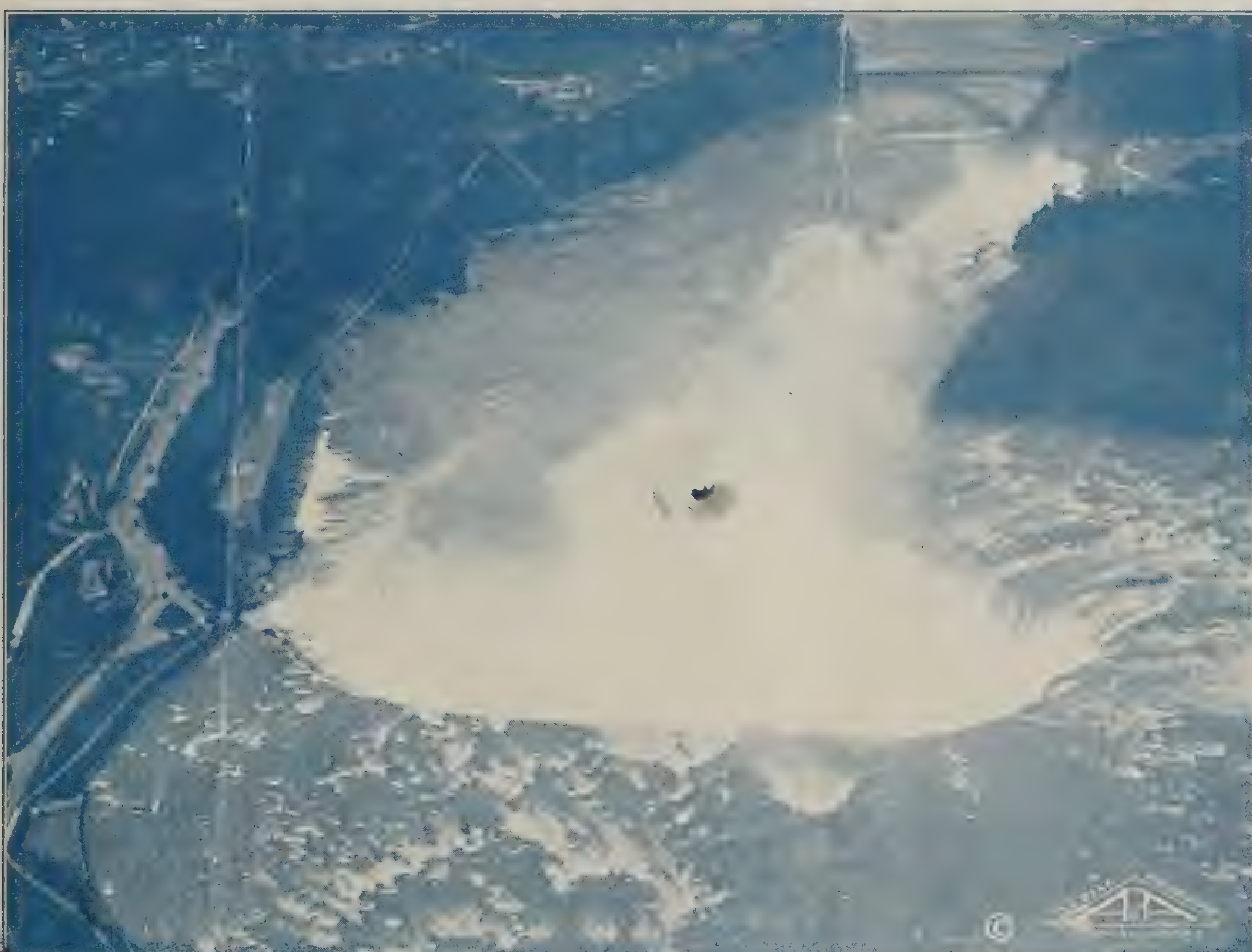
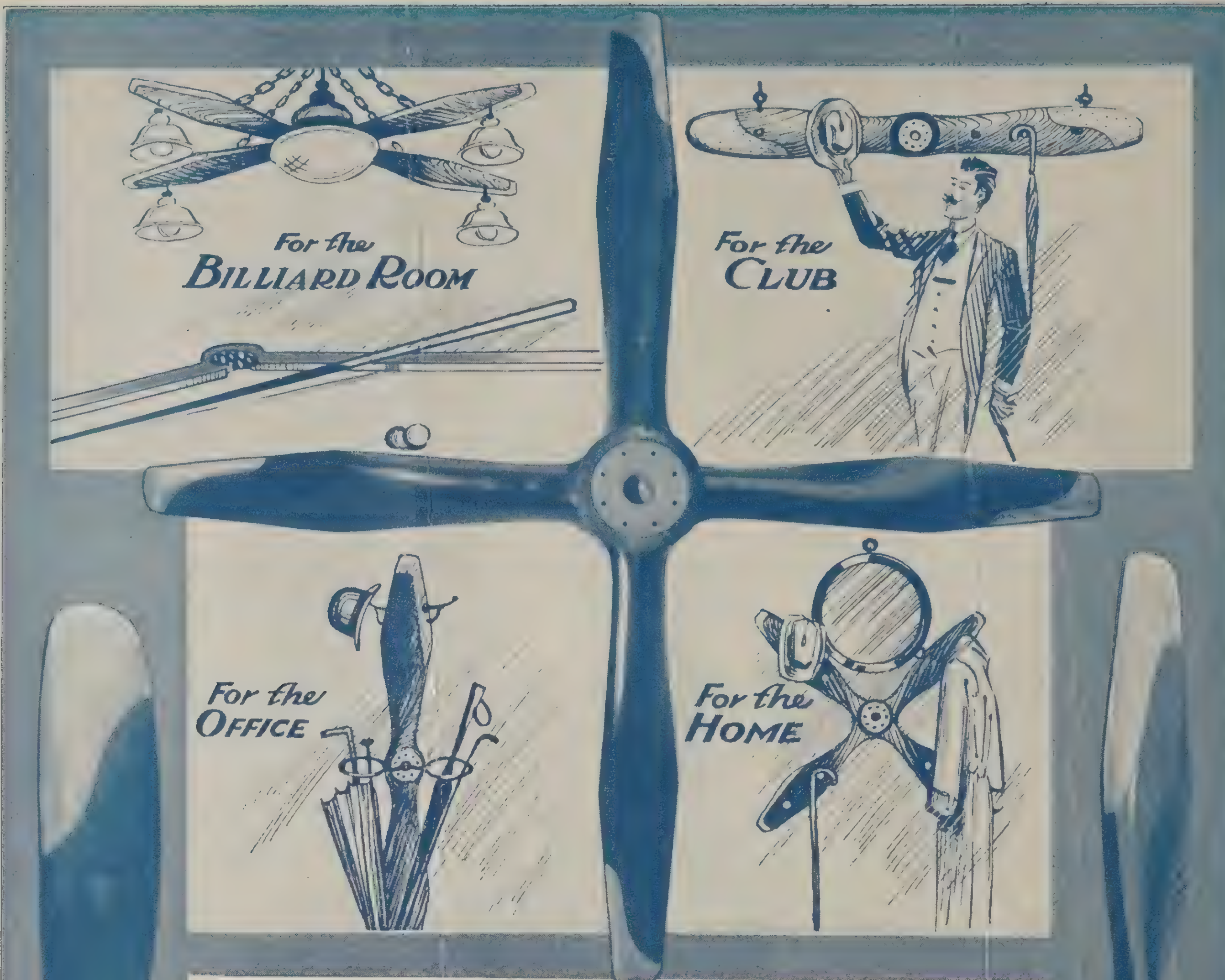


Photo copyrighted by Aerial Photographic Co. of America, Boston

Remarkable View of Niagara Falls Taken Directly Over The Brink At About 500 Feet Altitude

We Lag in Air Navigation

LISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
criptions: Domestic, $4; Foreign, $6. Entered as second-class matter March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879


For the
BILLIARD ROOM
For the
CLUB
For the
OFFICE
For the
HOME

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

LESLIE V. SPENCER, M.E.
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of
Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIII NEW YORK, MARCH 28, 1921 NO. 3

WE LAG IN AIR NAVIGATION

THE international convention regulating navigation of the air will become effective on May 1, and after that date pilots not registered in accordance with the terms of the convention must not fly over international boundary lines.

The United States has not yet provided for registration of pilots; consequently our airmen will not be allowed to fly over Canada, or if they are it will be by grace of the Canadian authorities.

It may be said that there is plenty of air over the United States to accommodate our flying men, and that before exclusion from Canada becomes a serious economic or sporting hardship we shall have made provision for the prescribed registration. This may be true, but it does not tell the whole story.

Our failure to keep abreast of the times in this detail of air navigation advance is characteristic of our attitude toward the subject of air navigation generally.

Instead of being in the van in improving aeroplanes and dirigible balloons we have permitted other nations to outstrip us in an art vital to national defence in war and of constantly increasing importance in transportation in peace. We have lagged far behind.

In 1917 and 1918 our neglect of air navigation made us dependent on our co-belligerents for essential weapons. In 1921 it threatens to exclude us from one form of neighborly intercourse with Canada. In some other year will it lay us helpless before an alert and prepared foe?

Air navigation should have immediate, wholehearted encouragement and support from Congress, and an aroused public sentiment should compel Congress to give that encouragement and support.—*Editorial in N. Y. Herald.*

Aerial Patrolmen Next?

A CIRCULAR order has been sent out by Police Commissioner Enright of New York City to all police precinct commanders to enforce an ordinance which was adopted by the Board of Aldermen on February 15 for the purpose of regulating aerial traffic above New York City. Just how the various precinct patrolmen are going to do this is rather puzzling. At present there is a motorcycle squad, the members of which trail highwaymen and holdup men, and perhaps the Police Commissioner will suggest the organization of an aeroplane squad to arrest prospective malefactors of the air.

The ordinance is very comprehensive and is designed to be operative only until Congress shall pass legislation to control and direct the operation of aircraft over all United States territory. In the ordinance it is specified that "aircraft" means aeroplane, hydro-aeroplane, seaplane, dirigible balloon "or other apparatus carrying one or more persons into or through the air," and all pilots of such craft are forbidden "to give any demonstration or trick flying or aerial acrobatics." Within the city limits no aircraft is permitted to fly at a height lower than 2,000 feet, and no person allowed to drop "any ballast, instruments, tools, containers, handbills, circulars, cards or other matter whatsoever, unless it be directly over a place established for that purpose."

If aerial traffic continues to increase as it has in the past few years the air policeman's lot will not be a happy one. In fact, the hardy pioneer regulators of aerial traffic will be exposed to more personal danger than the unlucky occupants of the motorcycle side cars, jocularly referred to as "bathtubs."

Your air patrolman of the future must be a sort of super patrolman. He must have an eagle eye, a steady nerve and an acrobatic ability equal to Fred Stone's or Douglas Fairbanks's; he must be able to jump from one aeroplane into another when pursuing an air fugitive, and he must be equal to all emergencies. There will be no safety zones up in the air. Nor will there be any aerial station houses. In fact, the city cloud sleuth will be hard put to it what to do with his prisoner after he has dragged him protesting from the sky. No instructions of this sort are furnished in the ordinance.

Then, too, if there should be a head-on collision in midair, how would your air patrolman summon ambulances? Would he have to qualify as a wireless operator in addition to his other accomplishments?

The Late Charles D. Thomson

IT is with profound regret that we record the demise of Charles D. Thomson, who recently joined the office staff of AERIAL AGE as associate editor, and who for two years previously had been the London representative of this publication. Mr. Thomson was an enthusiastic student of every thing pertaining to aeronautics, and had an intimate knowledge of European developments and wide acquaintance with the men at the head of aeronautic affairs in Britain, civil, military and naval. His passing is a distinct loss to the editorial staff of this publication.

Born in Scotland, of characteristically rugged parentage, Mr. Thomson was energetic physically and mentally. He served his country with distinction in France for two years, until he was made a prisoner of war. His eighteen months in German prison made their mark on his physique. He was really just beginning to overcome the effect of his wounds and gassing when a cold quickly developed into pneumonia, and like so many of his comrades who had been gassed, he passed over after only twenty-four hours illness.

The News of the Week

Aero Club of America's Club House at Hazelhurst

The Aero Club of America has accepted the offer of the Curtiss Company to fit up the Officers' Club at Hazelhurst Field for the members of the Aero Club of America. The club house will be ready by the 15th of May and will be comfortably furnished for the convenience of the members of the club and their guests, many of whom have arranged for keeping of their aeroplane at the field, and accommodations will be provided for visiting aviators from the different clubs of the country. Arrangements are also being made so members of the club and their guests may take flights in the air and the reserve officers, in co-operation with the Government, have the use of the Government machines.

The Pulitzer Race

The Aviation Country Club at Detroit is making elaborate preparations at that place for the Pulitzer Trophy Race to be held on Labor Day. The fastest machines of the Army and Navy will compete and special contests will be held in connection with this event.

U. S. Airmen Barred by Canada on May 1

The Manufacturers' Aircraft Association anounces that the Canadian Air Board has set May 1 as the time limit in which American army and navy pilots may fly over Dominion territory. Civilian aircraft and pilots from the United States also are barred.

The action is taken under the terms of the International Air Convention providing that pilots and aircraft entering other countries must be registered and licensed in their own country, thus guaranteeing airworthiness and responsibility of operation. All the powers including the United States, have subscribed to the convention. All Governments except the United States have established departments or bureaus with jurisdiction over aviation. There is no Federal agency in this country, and therefore no responsibility for aircraft or pilot.

At the request of the United States State Department, the Canadian authorities have hitherto permitted military and naval flyers to enter Federal machines on official business only, "pending the organization of a body in the United States having authority to issue civil aviation certificates and licenses in accordance with the International Air Convention."

Mobilize for Bombing Tests

Washington.—The mobilization of more than one hundred aeroplanes and several balloons, the aeroplanes including practically all the bombing machines in the army air service, has been ordered. The craft will be assembled at Langley Field, Virginia, and the purpose of the mobilization is for bombing tests on naval vessels.

The tests are to take place in June. In addition to the army service aircraft, all available naval air forces will be used. The lighter than air force will include dirigibles.

"This is the first opportunity we have had," the War Department official said, "for any real training service since the end of the war. We expect to have at Langley Field before the bombing tests take place about 100 planes of all types, including more than a score of the new big Martin bombers and the necessary personnel. The bombing flight training periods will also give pilots from other posts an opportunity to attend the air service officers' school at Langley Field."

It was made known that the flyers at Langley Field, as well as those who have been ordered to report there, are being trained in flying over water areas and dropping bombs on moving targets. Outlines of battleships drawn on the ground are being used in tests over land.

According to a report the ammunition stored at Langley Field is "enough to blow up both the Pacific and Atlantic fleets," the bombs varying in weight from 50 to 2,000 pounds. Command of the great armada of aeroplanes will be in the hands of Col. T. De Witt Milling, who was assistant to Brig.-Gen. Mitchell in charge of military aviation in France. Col. William C. Hensley is to be in charge of the balloons and dirigibles.

National Balloon Race

The Birmingham Civic Association, the Inter-Club Council of Birmingham, representing the Rotary, Kiawanas and other clubs, have invited the Aero Club of America to hold the National Balloon Race at Birmingham on May 21, 1921, and the sanction has been awarded to them to hold the race on that date. The cash prizes and trophies to be competed for will be announced later. The foremost balloon pilots of the country have signified their desire to enter this race, which promises to be one of the most successful ever held on account of the wide interest in ballooning and the necessity of selecting a strong team to go to Belgium and bring back the Gordon Bennett International Balloon Cup which was won by Lieut. Ernest Dumeyter last year. The following pilots have already signified their intention of entering the races:

Bernard von Hoffman, St. Louis; J. S. McKibben, St. Louis; John Berry, St. Louis; Lieut. Louis A. Kloor, U. S. N.; Roy Donaldson, Springfield, Ill.; Warren Rasor, Brookville, Ohio; H. E. Honeywell, St. Louis; Ralph Upson, New York, U. S. Army and U. S. Navy.

The Curtiss Marine Trophy

Rules for a flying boat contest will soon be prepared by the Contest Committee of the Aero Club of America. This race will probably be held on Long Island Sound and the rules will be announced later.

Capt. Hugh Willoughby Visiting Palm Beach

Capt. Hugh L. Willoughby, of Port Sewall and Newport, is in Palm Beach, the guest of his daughter, Mrs. James K. Clarke. Capt. Willoughby is one of the pioneer aviators of America. In years of service, at least, he is probably the oldest flyer living. Ranking with Langley, the first of the air men, and Wright and Curtiss, Capt. Willoughby has been experimenting with flying machines ever since they were made. He built his first plane in 1909.

Capt. Willoughby spent the past summer in flying over Newport in his new triplane, "The Swan." He recently made a trip in the Trans-oceanic plane, "The Big Fish," to Bimini.

Capt. Willoughby has a beautiful home on Sewall's Point, and is an enthusiast in motor boating as well as flying, having entered several speed boats in the Palm Beach regattas.

Two views of the new five-seater commercial plane built by the Nederlandsche Automobiel en Vliegtuig Onderneming. The particular characteristics of the machine are: Length, 9.50 meters; wing area, 30.6 sq. meters. The weight empty is 1100 K.G., and the total load, 650 K.G. The maximum speed is 170 kilometers per hour and the machine has fuel capacity for five hours flight. A220 H.P. Benz motor is used

Examination for Chief Aeronautical Draftsman

The United States Civil Service Commission announces an open competitive examination for chief draftsman (aeronautical). A vacancy in the Naval Aircraft Factory, Navy Yard, Philadelphia, Pa., at $15.04 per diem, and vacancies in positions requiring similar qualifications, at this or higher or lower rates of pay, will be filled from this examination unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer, or promotion.

Applicants should at once apply for Form 1312, stating the title of the examination desired, to the Civil Service Commission, Washington, D. C.; the Secretary of the United States Civil Service Board, Customhouse, Boston, Mass., New York, N. Y., Post Office, Philadelphia, Pa. Receipt of applications closes April 26.

Junker All Metal Monoplane Changes

Recent changes in the fuel feed line and carburetor air intake in the Junker Monoplane are said to have eliminated the fire hazard, for which these machines have received considerable adverse criticism. In the changes referred to, made by the Engineering Division at McCook Field, are included flexible gasoline line connections instead of rigid and the carrying of the air intake outside the cowling where there is no danger of oil and gasoline around the engine being ignited by "backfiring."

Strangler Ed Lewis To Have Plane

Wichita, Kan.—After taking a ride in an aeroplane, Ed. Strangler Lewis, world champion heavyweight wrestler, placed an order for a machine, and stipulated that it be delivered to him as soon as possible.

New Tailspin Record

Lakeland, Fla.—Declaring that his aeroplane made a total of twenty-eight revolutions in one minute and fifteen seconds in dropping from an altitude of 8,600 feet to 800 feet, George W. Haldeman, former Air Service aviator, claimed he had broken the world's tailspin record. The flight in which the drop occurred was made March 13 over Lakeland. The official tailspin record is 7,000 feet.

Haldeman carried one passenger, W. F. Hallam of Chicago.

Havana Becomes Mecca For Airplane Travelers

Havana.—Havana is now the Mecca for the air travelers from the United States. The opening of the Palm Beach-Havana line caused Colonel Yero Miniet, superintendent of customs, to issue orders for the immediate clearance through the customs of all passengers arriving via seaplanes from Florida points.

Mrs. J. Borden Harriman, of New York; Prince Margot Alfonso de Bourbon, cousin of the King of Spain; Hannibal J. de Mesa, Mr. and Mrs. Frederick Lewisohn and Miss Julia Lewisohn hurried into the Sevilla several days ago, the first air passengers from Palm Beach and first to be honored by the special customs inspection. A second plane arrived later from West Palm Beach, whose passengers included Sumner Wells, chief of the Latin-American Bureau of the State Department; Harry Oakes and Mr. and Mrs. Harry Severin.

Roma Makes 500 Mile Trip

Rome.—The big dirigible Roma, bought from Italy by the United States Government, made a successful trial voyage of 500 miles March 15, in seven hours and fifty-two minutes. Ambassador Johnson and a party of American men and women were in the car during the trip and had luncheon while over the picturesque Sorrento peninsula.

Signor Usuelli, the builder, announced he would immediately begin another giant craft four times the size of the Roma. He said the vessel would be capable of flying for a fortnight without alighting, and that with it it would be possible to circle the world.

UNITED STATES POST OFFICE DEPARTMENT AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, January, 1921

DIVISION	Gasoline	Grease and Oil	Repairs and Accessories	Miscellaneous	Motorcycles, Trucks	Rent, Light, Fuel, Power, Telephone and Water	Office Force and Watchmen	Pilots	Mechanics and Helpers	Departmental Overhead Charge	Interest on Investment	TOTAL	SERVICE AND UNIT COST					
													Gallons of Gasoline	Total Time Run	Total Miles Run	Miles Run per Gallon of Gasoline	Cost per Hour	Cost per Mile
														hr. min.				
New York-Washington..	$1,789.96	$366.00	$1,268.93	$2,617.15	$967.55	$648.18	$1,002.52	$1,052.04	$1,845.51	$232.84	$532.50	$12,323.18	4,621	150 25	12,220	2.6	$81.92	$1.01
St. Louis-Twin Cities..	2,930.09	562.17	2,373.73	3,432.72	1,140.51	728.93	2,415.62	2,590.86	4,170.99	698.51	1,125.34	22,169.47	8,116	313 23	22,501	2.8	70.74	.99
New York-Cleveland....	2,441.46	958.53	3,172.35	1,739.08	861.08	600.79	1,798.52	1,805.47	3,208.43	465.67	1,756.67	18,808.05	6,607	194 49	16,428	2.5	96.54	1.14
Cleveland-Chicago.....	1,767.48	319.87	5,046.26	1,621.51	437.38	266.37	1,209.15	1,748.59	2,152.85	349.25	691.67	15,610.38	4,896	175 00	16,643	3.4	89.20	.94
Chicago-Omaha......	1,697.54	247.74	3,357.12	1,525.51	364.75	223.08	991.11	1,682.60	2,115.61	465.67	950.00	13,620.73	5,309	175 11	16,170	3,0	77.75	.84
Omaha-Salt Lake....	4,776.13	1,119.80	5,152.95	1,538.84	1,005.82	600.47	2,540.74	3,468.63	2,995.29	970.15	625.00	24,793.82	12,965	346 46	28,807	2.2	71.50	.86
Salt Lake-San Francisco	3,155.78	729.18	7,635.42	6,316.05	1,232.98	337.50	2,178.55	3,083.94	3,095.08	698.50	700.00	29,162.98	8,973	313 17	27,840	3.1	93.08	1.05
Totals and Averages....	$18,558.44	$4,303.29	* $28,006.76	$18,790.86	$6,010.07	$3,405.32	$12,136.21	$15,432.13	$19,583.76	$3,880.59	$6,381.18	$136,488.61	51,427	1,668 51	139,609	2.7	$81.78	$0.98

* Increase over December due to machine overhauling work on ten planes.

Planes operated on New York-Washington Division:
Curtiss R4's, equipped with Liberty 12 motors.
De Havilands, equipped with Liberty 12 motors.
Curtiss JN4D's, equipped with Curtiss OX5 motors. (Used for testing pilots).

Planes operated on St. Louis-Twin Cities Division:
Standard, equipped with Hispano Suiza motors.
Curtiss JN4D's, equipped with Hispano Suiza motors.
Twin De Havilands, equipped with two Liberty 6 motors.

Planes operated on New York-Cleveland Division:
Curtiss R4's, equipped with Liberty 12 motors.
De Havilands, equipped with Liberty 12 motors.
Twin De Havilands, equipped with two Liberty 6 motors.
Curtiss HA's, equipped with Liberty 12 motors.

Planes operated on Cleveland-Chicago Division:
De Havilands, equipped with Liberty 12 motors.
Twin De Havilands, equipped with two Liberty 6 motors.
Martin, equipped with two Liberty 12 motors.

Planes operated on Chicago-Omaha Division:
De Havilands, equipped with Liberty 12 motors.
Junkers (J. L. Larsen), equipped with B.M.W. motors.

Planes operated on Omaha-Salt Lake Division:
De Havilands, equipped with Liberty 12 motors.
Junker (J. L. Larsen), equipped with B.M.W. motor.

Planes operated on Salt Lake-San Francisco Division:
De Havilands, equipped with Liberty 12 motors.

COST PER MILE			
Division	Overhead	Flying	Maintenance
New York-Washington..........	$0.28	$0 26	$0.47
St. Louis-Twin Cities..........	.27	.27	45
New York-Cleveland...........	.33	.32	.49
Cleveland-Chicago..............	.18	.23	.53
Chicago-Omaha	.19	.22	43
Omaha-Salt Lake...............	.20	.32	.34
Salt Lake-San Francisco.........	.19	.25	.61
Entire Service..................	$0.23	$0.27	$0.48

OTTO PRAEGER, Second Assistant Postmaster General.

Giant Aeroplane Under Construction

The Continental Aircraft factory at Amityville, Long Island, was taken over some time ago by Capt. Charles Cox, and construction started January 1st on a giant aeroplane of a new design. The enterprise is financed by George C. T. Remington. Mr. Remington is a grandson of the late George C. Thomas of Philadelphia and a son of Mrs. W. Schuyler Volkmar of Coronado Beach, California. For the past ten months Mr. Remington has been in the aviation section of the United States Navy. Although he has been interested in aeronautics for a number of years, this is his first venture in commercial aviation. He was released from the Navy last week and is now on his way east to take an active part in the work. He was married in September to Miss Beatrice Clark of New York and Newport.

On completion of the plane Captain Cox will attempt a one-stop flight to California with a cargo of passengers and freight. Captain Cox is one of the most experienced large plane pilots in this country. During the war he served with a Handley Page Squadron and later was an instructor on the four-motor Handley. On his return to this country he was engaged as pilot by Alfred W. Lawson and piloted the Lawson Air Liner on its flight from Milwaukee to New York, Washington and return.

The engineering is in charge of Mr. V. J. Buranelli, who, with Captain Cox, is responsible for the design. The plane is a considerable departure from anything yet built. It is on the thick wing order. The cargo and engines are carried in a wing. Mr. Buranelli's broad experience qualifies him for this responsible work. He formerly was chief engineer of the Lawson Company of Milwaukee. From there he went to the Nebraska Aircraft Corporation. Having recently resigned the position of chief engineer and factory superintendent of that company to associate himself with Captain Cox and Mr. Remington. The construction of the plane is well under way. At the present writing it is more than half finished and is expected to be ready for test about May 15th.

Zeppelin Negotiates for French Financing

New York.—Advices from London say that great indignation has been aroused in Germany by the report that negotiations are in progress for a French company to acquire a controlling interest in the Zeppelin company.

In the course of an interview, Director Coleman of the Zeppelin company states that his company reluctantly arrived at the conclusion that it can no longer exist as a purely German enterprise, and that it was essential that it should be converted into an international organization.

With that end in view he admitted he was in negotiation with a French company in Paris, but the negotiations have not yet advanced beyond the preliminary stage.

Premier Air Line Organized

The Premier Air Line has been organized in Clarksburg, West Virginia for passenger carrying, cross-country trips and exhibition flying. George P. Bell is Manager of the Company and L. C. Perry will act as chief pilot.

Capt. Charles Cox, who is now engaged in the construction of a giant commercial aeroplane

New Designs Accepted by the Navy

Washington.—In the first open aeroplane design competition to be conducted by the Navy Department five designs for a new type of naval plane have been accepted on preliminary examination out of forty submitted by thirty corporations and individuals, it was announced March 15. The competition was held to develop a type of plane specially suited for use in spotting and control of battleship gunfire at sea.

The five designs, including one each submitted by the Curtiss Company and the Dayton-Wright Company, will be subjected to a final examination to determine the order of merit of the best four. These will be purchased at sums ranging from $16,000 for the best to $3,000 for the fourth.

George C. T. Remington, who is co-operating with Captain Charles Cox in the construction of a giant commercial aeroplane

National Aircraft Underwriters' Association

The National Aircraft Underwriters' Association is announcing to its members that it is delegating the current work in connection with the conduct of the Association to the National Workmen's Compensation Service Bureau and the official office of the Association will hereafter be at the Bureau rooms—13-21 Park Row, New York City. This move does not contemplate the merger of the Aircraft Association with the Bureau, and the Aircraft Association will retain its separate identity precisely as heretofore.

It has been announced previously that the Compensation Bureau is prepared to assume work of a secretarial and actuarial character for insurance organizations and without question the experience of the Bureau in handling insurance matters and in preparing data for rates and rating methods will be of distinct service in the aircraft insurance field. Mr. Ambrose Ryder will act in the capacity of manager of the Association, the other officers remaining unchanged.

The Aircraft Association will collect statistics and other information from outside sources as well as compile the statistics of member companies and undertake an analysis of all accidents. It will undertake to bulletin its active and associate members concerning the developments in the aircraft field and similar matters of interest. It will engage in the study and development of insurance on cargoes and a study of the possibilities of insurance as related to the personnel and cargo of lighter-than-air machines. tI will undertake a compilation of laws and regulations governing travel by air and will assist in all proper movements for national uniformity of aerial laws and regulations.

This move is due in a large measure to the arrangements between the Aircraft Association and Underwriters' Laboratories, Inc., whereby the Laboratories have undertaken various features of aircraft work, which correspond quite closely to the scope included in Lloyd's Aircraft Registry. It involves the following features:

1. Classification of types of aeroplanes as to aerodynamic features, structural strength and operating characteristics.
2. Registration of individual aeroplanes as to classified type, service, repairs, etc.
3. Registration of individual engines as to maker, type, rating, service period and overhaul.
4. Registration of firms undertaking to rebuild or repair aeroplanes.
5. Registration and classification of landing fields and aerodromes including ground discipline.
6. Registration of pilots as to training and qualifications.

All of this work is to be undertaken with the co-operation of the National Aircraft Underwriters' Association and of the manufacturing industry, and cannot fail to be of distinct service in regulating and controlling air traffic and in reducing aerial hazards.

FACTORS AFFECTING FLIGHT

By W. G. LANDON

A GREAT many manoeuvres in flying are accomplished with such ease that often too little attention is given to the theory affecting the case. The result is that a pilot, perfectly at home on one machine may, in doing stunts on another find himself in difficulties he imagined impossible. This, no doubt, is the cause of many crashes for which there is no plausible explanation. Then again machines may get in positions in which they are somewhat out of control in the ordinary sense of the term. If all the forces acting on an aeroplane are known, such predicaments may be avoided or rendered harmless.

It may be argued that such considerations are only of interest to those doing stunts. This brings up the question of stunting, which to many may seem useless. It has nevertheless great value. A pilot familiar with the various stunts, will, if he finds himself in trouble, know what to do to bring the machine down with the least damage. For example, if the rudder should jam in extreme right or left positions, he would avoid pulling the stick back and getting into a spin, and instead would side slip down. On the other hand, the pilot who has never done any stunts, might on such an occasion do the wrong thing. Pilots will testify that it takes some practice to get used to spinning. The first spin is rather confusing, and the pilot who accidentally has his first experience close to the ground, will in nine cases out of ten try to pull his nose up by pulling the stick back, and crash. The stunt pilot would instinctively push the stick forward, stop the spin, and then flatten out. Stunting on the right kind of machine is not the least dangerous, and it would seem most beneficial to require all pilots to do the simpler stunts or at least the spin, which has such a long list of victims.

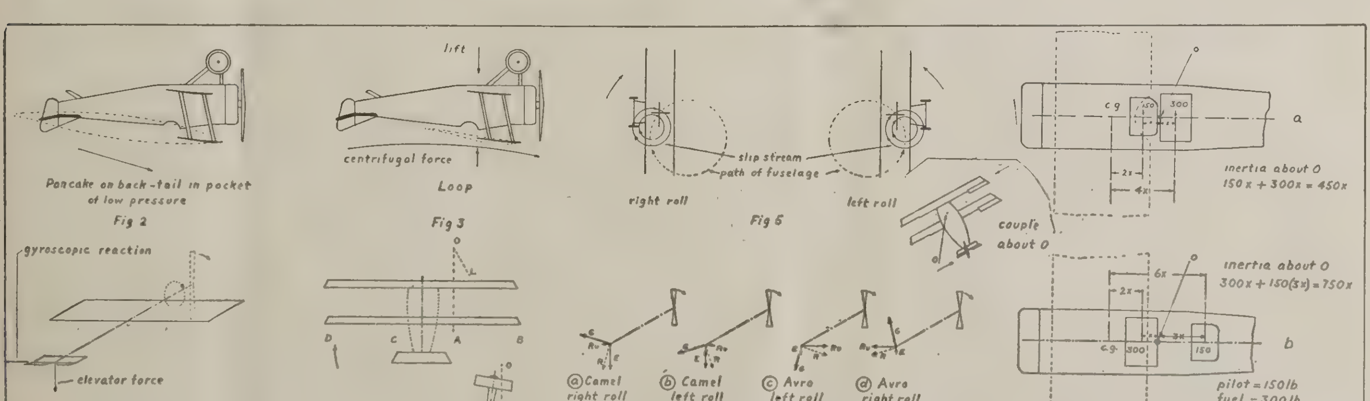
To begin with, it will be well to consider the various forces, which, in addition to the control surfaces, can affect the aeroplane. First there is the twirling motion of the slip stream, which tends to revolve the machine on its longitudinal axis in the same direction as the propeller. Its action is on any part in its path such as the main planes, fuselage and tail. Secondly the torque of the motor, which tends to revolve the machine in the opposite direction to that of the propeller. In straight flight, this more or less neutralizes the slip stream, any inequality being adjusted by changing the incidence of the planes on one side or the other. When, however, any deviation from the straight is made, the slip stream column is diverted, and no longer strikes the tail normally but passes above, below or to the side according to the manoeuvre. The degree of displacement of the slip stream will depend on the length of the fuselage, and whether the manoeuvre is sudden or gradual. In addition to the twisting motion of the slip stream, there is also the effect of its speed which relative to the machine, is 25% faster than the surrounding air. Thus any part of the tail which is out of the slip stream will be less sensitive to the action of the controls. Thirdly the gyroscopic action of rotary motors, which results from the fact that any force applied in a plane perpendicular to the axis of the gyroscope, produces a resultant in the same plane at 90° from the force, measured in the direction of rotation of the gyroscope. In loops and vertically banked turns, effect is especially noticeable on a machine with a short fuselage. It is less apparent with a long fuselage on account of the greater leverage of the control surfaces. In the loop, the motor, if turning in the usual direction for rotaries as indicated in Fig. 1, tends to turn the machine to the right. Consequently left rudder must be used to counteract it. Similarly on right hand vertical turns, the nose of machine will tend to drop and must be offset by top rudder *i. e.,* left rudder and on a left hand vertical turn the nose will tend to rise and must be offset by bottom rudder—in this case again left rudder, so we have the peculiarity of having the controls in practically the same position for right and left vertical turns, though naturally they are not started in the same way.

The Sopwith Camel offers some interesting phenomena in looping. If the stick is pulled back too far, an upward roll is started which ends in a stall in some position varying from vertical to upside down. If the stick is not pulled back far enough there is a tendency to get stuck at the top of the loop and once a Camel is on its back, it seems to like to stay there. A cyncial S.E.5 pilot, who didn't like Camels, said that if they would put the under-carriage on the other side, he might enjoy flying one. Anyway I have heard many a pilot say that he got a Camel on its back and could not for an intolerably long time get the machine righted. Many never did get straightened out, and so did not express their opinions. One man, in this usual Camel predicament, on discovering that the ground was uncomfortably near, changed his tactics, glided the bus down on its back, pushed the stick forward, ducked his head into the office and made a nice landing upside down, much to the astonishment and admiration of a group of pilots looking on.

The usual advice was "When you get a Camel on her back, don't pull the stick back." Some advocated pushing it forward and others to the side. I asked for reasons but never received one. On the face of it, to push the stick forward would result in keeping the machine inverted. I have had a Camel on its back many times and always found by pulling the stick right back, and then easing it forward as soon as she started round, brought her out very nicely. But there are other aspects of the case. If the machine starts pancaking on its back, what sort of a wake will the tail, which is not far removed from the main planes, be in? If a pocket of low pressure is found around the tail plane, Fig. 2, will it frustrate any attempt to righten the machine by pulling back the stick as if completing a loop? Of course it must be remembered that at the top of a loop properly executed, the machine is still flying normally, the centrifugal force acting opposite to gravity and the lift or rather pressure on the cambered side of the planes acting downward, Fig. 3.

Apropos of this, the tail plane may also be unfavorably influenced on certain machines, when flying right side up. The D.H.6, an English training machine, had a very pronounced camber on the planes, so much so that it was nicknamed the clutching hand. Driving this bus at 90 caused a wake which made the upper side of the elevators ineffective. However, by pushing the stick forward and then back, the wake was altered sufficiently to enable the elevators to act and permit the machine to come out of the dive. Also by increasing the speed to 100 or more, the top portion of elevators again became effective. Later models of this type had planes of more normal camber and the trouble mentioned disappeared.

Another much discussed question is rolling. The method varies with different machines. In the Spad, moving the stick to the side does the trick. In most machines it is necessary to pull the stick back and ride on rudder. In any case the necessary turning movement is secured by increasing the lift of the wings on one side over those on the other. If the ailerons alone are used, the difference in lift of the wings will depend largely on their surface and angle. If the rudder is used in addition (right rudder with right stick) the effect is to increase the speed and lift



of the left wings and augment the effect of the ailerons when the stick is pulled back, and to one side, simultaneously with rudder, the increase of angle of incidence of the main planes assists the roll. The reason for this is shown in Fig. 4. Assuming the machine to be doing a right roll, it will revolve about some axis LO, viewed from behind. All the wing surface to the left of A O tends to make the machine roll, while that to the right resists. But the parts A B offset the parts A C, leaving the effective surface C D. So the greater the incidence on C D, the greater the lift and rapidity of the roll. In rolling with the engine off, it does not make much difference whether it is to the right or left, it merely being necessary to get up the requisite speed. In rolling with the engine on, however, a lot of other forces come into action, such as the slip stream, torque and gyroscopic effect in rotary motors. It should be remembered that the slip stream consumes time, however short, in travelling from the propeller to the tail and in rolling the machine will have revolved some degrees about an axis above the fuselage. Therefore the centre of the slip stream will no longer pass through the fin and rudder and throughout the roll the centre of the tail will precede the centre of the slip stream. How much will depend on the speed of the machine, the rate of rotation of the roll, and the thickness of the fuselage, which will tend to keep the slip stream concentric with it; length of fuselage and displacement of tail in Fig. 5. It will be seen that the slip stream helps the right roll, while it resists the left roll. If however the tail is clear, or partly clear of the slipstream, the influence will be reduced. The torque, as mentioned before, tends to turn the machine in the opposite direction to that of the propeller. In rolling a rotary, the resultant force produced by the gyroscope will depend on which of the tail controls predominates. To assist the roll, it must either help the rudder or it must tend to pull up nose and thus help the elevators. If it acts greatly in opposition to either of these, it will make the roll difficult, if not impossible. In the Camel, Fig. 6, the elevators are more sensitive than the rudder, so that the resultant of these two forces comes close to the elevator force. Therefore in a right roll, the gyroscopic reaction (G) will aid the rudder, and assist the roll. In a left roll, the gyroscopic reaction is merely shifted a few degrees and interferes with the roll. Where the rudder has the preponderance of force as in an Aero, the machine may roll to the left more easily, other things being equal. In Fig. 6c, the force G acts with the elevators and makes the roll possible. In d it is almost opposite to the elevator force, and consequently resists the roll.

The spin is much the same as the roll except that it is performed in a vertical instead of a horizontal direction. Many will dispute this, claiming that the machine has no flying speed. If, however, they will observe the pilot in a spin, they will find it registering 60 or more, or if they will spin 1000 ft. and time it they will find it anything but lacking in flying speed. Spinning is done with the stick back and rudder. The ailerons may be used to increase the rate of rotation or they may be used to decrease it. Right stick with right rudder naturally increases the rate of spin, whereas left stick retards it. An interesting way of coming out of a spin where there is plenty of room underneath, is to gradually move the rudder back to central position. This results in the spin becoming wider and flatter until finally the machine is doing a vertically banked turn. This illustrates the development of a spin into a spiral.

Pilots have got into inverted or upside down spins, in most cases involuntarily. Thus instead of the machine revolving on some axis near the pilot's head, it revolves about one near the undercarriage and the centrifugal force tends to throw the pilot from his seat instead of holding him to it as in the ordinary spin. Such a state of affairs is probably brought about when the machine is on its back and the stick pushed forward and rudder kicked on. Such spins are in the class of under loops, bringing excessive pressures on the wrong side of the planes for which they were not designed. It is well to avoid such stunts. In this connection an incident will serve as an illustration of the know-it-all, sometimes seen in pilots. A pilot in training did several rather poor loops on his first solo. But he was rather pleased with himself and did not disguise the fact in the mess. An old pilot who had witnessed the performance said, "Why don't you do an under loop?" The young genius replied, "All right, I will," and he did and buried himself very effectually.

An interesting problem is: if a machine is doing vertically banked circles at a uniform height, what supports it in the air? Some will answer centrifugal force but this is not so. Centrifugal force is acting in a horizontal direction. Others will say the fuselage, but if this is so, why not do away with the wings? The answer is that the machine cannot fly in a circle without loss of height with the average angle (if there is dihedral) of the planes at 90° to horizontal. The angle must be sufficiently less than 90° to furnish the necessary vertical component of force to uphold the weight. In the same way a stone being twirled round on a string apparently horizontal, is actually not horizontal. Herein lies the vertical component which holds the stone up.

Another item affecting sensitiveness of control is the weight distribution in the machine. An example is shown in Fig. 7, (a) representing the fore part of the fuselage of an ordinary Camel, and (b) a modification of the same design, dubbed the "Comic Camel". The object sought was to better the view for the pilot and provide a gun on the top plane. The tank was moved forward and the pilot's seat backward, the centre of gravity remaining at the same point. The machine turned out to be much heavier on the controls and slower in manoeuvring. In seeking the cause for this, it should be remembered that in straight flying the tail is practically in equilibrium. When, however, the elevators or rudder are used a thrust is developed forming a couple with the main planes. The fulcrum of this couple is at some point O back of the main planes. When it is attempted to revolve the machine about O as in a turn or loop, the inertia of the whole machine resists and is the same in (a) and (b) with the exception of the gas tank and pilot. Estimating these values we find that in (a) the inertia is 450 x and in (b) 750 x or considerably more. Thus a concentration of weight near the fulcrum O tends to make the machine light on controls. Since the gyroscopic effect is produced by the movements of the tail, and to all intents and purposes, may be taken as acting at the tail, it follows that a machine with a concentration of weight near O would be much influenced by the gyroscope, whereas one in which the concentration is remote from O would be less affected. This is borne out in practice.

It is obvious from the above that there are a good many forces which affect flight, and these must be given some consideration both in design and in flying if the desired results are to be obtained.

CO-ORDINATION OF ARMY AND NAVY PRACTICES IN REGARD TO EXPERIMENTAL CONTRACTS FOR AIRCRAFT

THE Secretary of War and the Secretary of the Navy recently approved the recommendations of the Aeronautical Board with regard to the arrangement of a form of development contract suitable for the purchase of new designs of planes and engines of an experimental nature. Consideration has been given to the necessity for stimulating the proposal of original designs to meet military and naval requirements, and to the possibilities of obtaining competition; what guarantees as to weight and performance should be made by the contractor, and what penalty and bonus features, if any. The status of patent rights and royalties on subsequent production orders has also been considered, and particular attention has been given to procedure which will insure that development contracts are awarded only to competent firms with no show of improper favoritism.

An "experimental contract" as understood by the two services means a contract calling for the development of design and construction of generally three airplanes of new or modified type—Government to supply engines and special equipment. An analogous definition could be drawn for engine contracts.

Methods of procedure followed by the Army and Navy are different in many particulars. On account of differences in organization, it is not possible to reconcile the two completely, nor is this considered necessary. One fundamental difference appears to be that the Navy method calls for more minute inspection of, and closer supervision over the work of a contractor during the life of his contract. Guarantees of weight and performance are included and a short series of acceptance tests required from the contractor on the first machine built. The Army method calls for less inspection during construction, and less supervision over the contractor. No definite guarantees of weight or performance are included and a longer time is devoted to tests conducted by Army personnel at Army expense on each of three machines. The Army method calls for construction of a mock up and then three machines in sequence with an appreciable interval elapsing between the first and second, and second and third machines. The Navy method permits the simultaneous fabrication of three machines so that after the first is completed the second and third may follow within short intervals. These different procedures each have merit and

are not believed to be a handicap to any aircraft manufacturer with proper facilities and organization.

The business features of aircraft contract, such as bond requirements, method of advertisement, form of contract, differ in various particulars. On account of administrative policies, organization, etc., it is not possible or necessary to reconcile these differences or to suggest a type form of contract. Such differences as exist are not of enough importance to warrant attempts to change well established procedure.

Prices considered reasonable for certain types of aeroplanes and for designs have been discussed. Very little cost data of value is available, and it is desired that reliable data be accumulated as rapidly as possible. To this end the assistance and co-operation of various aircraft manufacturers is desirable. Meanwhile, intimate exchange of data on contracts between interested branches of the two services as later recommended is the best method of reconciling prices.

Considering particularly the technical features included in a contract, the following are recommended:

That the data to be submitted by a bidder be essentially the same for Army and Navy bidding and consist of approximately the following:

- An accurate scale three-view drawing of the design.
- An itemized weight schedule.
- A balance diagram and schedule.
- Proposed structural strength of various component parts of the aeroplane with calculations.
- Calculated performance of the aeroplane with all calculations.
- Drawings showing installation of all armament, equipment, instruments and accessories.
- Drawing or drawings showing engine installation including fuel, oil, and cooling systems.
- A statement of materials to be used.
- Typical cross section of the fuselage showing method of construction, typical fittings, etc.
- Typical cross section of a wing showing ribs, spars, methods of construction, typical fittings, etc.
- Lines pontoon, boat hull or flotation system with buoyancy calculations.
- Typical cross section of pontoons or boat hull showing method of construction.
- Where a bidder's design is to be paid for, as later recommended, the above should be minimum requirements with additional data to be required to suit special problems. In addition, there may be required to be submitted with a bid a small model to suitable scale showing the general features of the design. This is not to be a wind tunnel model.

That the two services adopt the policy of paying a sum stated in proposal for each design submitted (not to exceed a specified number, usually three for each type, selected by the Government as the best, the Government's decision to be final) that shows sufficient completeness and merit to justify such payment; the amount to be sufficient to cover the estimated cost of preparation of such design with a reasonable profit. Award of construction contract not to preclude payment for design. Payment for any design to convey to Government, without further consideration, the non-exclusive ownership of that design, together with the right to use the same, or any portion or feature thereof, and all information and data furnished, in any manner deemed advisable by the Government. Once a design is submitted to and paid for by either service, it may be submitted in that form, or slightly modified, to the same or other service, but no additional payments therefor will be made.

Where static testing is required the methods used by the two services should be co-ordinated.

That definite and reasonable weight and performance guarantees be required from contractors.

That each service continue the use of its own detail specifications defining workmanship, finish, etc. The differences that exist are of minor character and are justified by service conditions.

That each service continue its present practice of awarding contracts only to firms that are considered competent.

That the Technical Sections of the Army and Navy Air Services have complete cognizance of the details of the work being carried on by these Sections, and that in this connection each service be kept informed of proposals for bids upon contracts, and all matters dealing with prices, features of design, installation and operation of aeronautical material in order that duplication may be avoided and progress best assured in the development of design, and in the operation of aeronautical mechanisms.

The above comments apply more particularly to aeroplanes without engines, but parallel recommendations should apply to engine experimental contracts.

The discussion and exchange of ideas on this subject has been of mutual benefit and value. The degree of co-ordination above recommended, it is believed will be helpful to all concerned and prove of assistance to aircraft manufacturers during the present uncertain period in the industry.

THE FACTORS THAT DETERMINE THE MINIMUM SPEED OF AN AEROPLANE

By F. H. NORTON

Aerodynamical Laboratory, N. A. C. A.

A LARGE range between the maximum and minimum speeds of an aeroplane is of undisputed value, either to permit safe landings in small fields with the medium or slow speed machine, or to permit landing at all with very high speed machines. The factors which limit the maximum speed are well understood, but rather strangely the limiting factors of the minimum speed have seldom been recognized. The whole question of minimum speed has usually been settled by the statement that the wings have reached the point of maximum lift, whereas there are very few aeroplanes that can be flown at, or beyond, this point, and a great many that cannot reach within 5° of it. Because of this general misunderstanding of the principles of flight at low speed there are a large number of machines that could be made to fly several miles slower than at present by slight modifications. In the following paragraphs, therefore, the factors that affect the minimum speed will be discussed with the hope that some of the present uncertainty will be cleared up.

The wing section has a large effect on the minimum speed of an aeroplane because this determines the maximum lift coefficient of the supporting surface. This lift coefficient is usually found from model tests in the wind tunnel, and in order to show the range of values obtained and the approximate sections for each, the table in next column is given: Of course, if a slow speed were the only consideration, the highest lift wing would be chosen; but usually it is speed range that is the object, and the selection of a wing for this purpose comes beyond the scope of the discussion. In order to show how greatly the wing section affects the minimum speed, curves are plotted in Fig. 2 against various loadings.

If a number of lift curves from model tests are examined it will be found that the lift falls off beyond the maximum in some cases slowly as in curve (1) in Fig. 3, some rapidly as in curve (2) and some, especially the high lift sections, drop off suddenly (curve 3). Now it certainly would be most awkward when pulling up the nose of an airplane in making a landing to have the lift fall off suddenly 25 or 50 per cent, and for this reason it was formerly thought unwise to use wings that showed a discontinuous lift curve in the model.

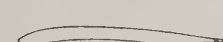
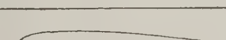
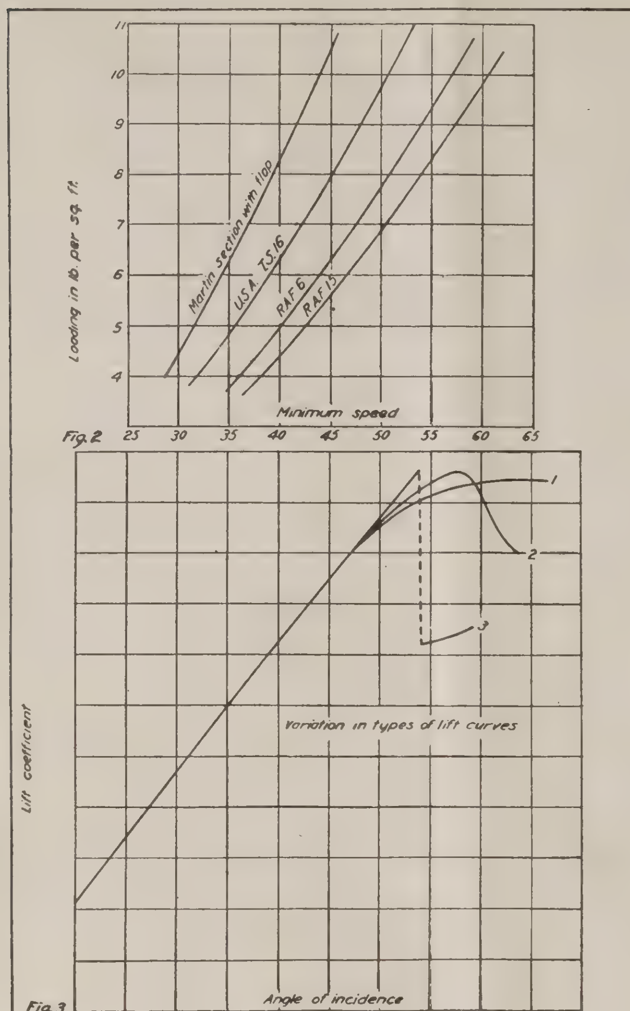
Section	Shape	L_c- M.P.H. Lbs/Sq.ft	L_c- Absolute
R.A.F.15		00274	.538
R.A.F..6		.00308	.604
U.S.A.T.S.16		.00393	.770
Martin with flap		.00516	1.005

Fig. 1



However, more recent tests have proved that if these sections are run at a high enough speed the discontinuity disappears. Also the fuselage in combination with the wings has the property of flattening the burble point. These facts are shown very strikingly in Fig. 4, where the lift curves are plotted for a model wing, the same wing in a model aeroplane, and the full-sized aeroplane.* The lift values show a close agreement up to 16° where they begin to diverge, the full-sized machine continuing straight on, the model wing falling off rapidly, and the model aeroplane taking an intermediate path.

The disposition of the wings on the aeroplane slightly affects the lift coefficient and a few cases will be discussed. The aspect ratio has a slight effect on the maximum lift as shown in Fig. 5.** A biplane will have a maximum lift of about 96% of that of a monoplane, while a triplane will give only 92%. In some cases a monoplane seems to give an abnormally high lift due to the cushioning effect of the air between the ground and the wing, but no really accurate tests have been made of this. However, a model of the JN biplane has been tested in the tunnel at varying distances from a flat surface representing the ground and it was found that the lift and drag at the three-point landing angle with the wheels just free of the ground were each increased 5%.*** It would be expected that a monoplane with a wing close to the ground would show an even greater effect than this. Stagger also has a slight effect on the lift, as shown in Fig. 6****, and gap chord ratio has still less (Fig. 7).*****

It has been found that the lift coefficients from models can not be applied directly to full-sized machines, and this is especially true in regard to the high values in which we are interested. It is difficult to obtain values of the lift coefficient in full flight at the burble point due to the great skill required to fly a machine steadily at this angle. The burble point, however, was reached with a JN4h aeroplane (Fig. 4) in one case. It has been the practice to compute the landing speed of a machine from the maximum lift coefficient obtained on the model wing, and by a coincidence this procedure is very nearly correct as the full-sized machine lands at an angle of attack much lower than the burble point. It is necessary, therefore, to make a distinction between landing speed and minimum speed, the former occurring between 10° and 14° and the latter between 18° and 20°. As will be shown later, this difference is due mainly to the fact that the controls are not powerful enough to safely hold the nose of the machine up in a glide.

There is one other factor associated with the wings that has a definite, although usually slight, effect on the minimum speed, and that is the extra lift exerted by the slip stream on the wings. If the weight of the machine W is assumed to be supported only by the wings—

$W = L_c AV^2 - m L_c . n A . p^2 V^2$ where

L_c is the maximum lift coefficient of the wings.

A is the area of the wings.

V is the minimum speed.

m is the ratio of the lift coefficient at the angle between the wings and the thrust line to the maximum lift coefficient.

n is the ratio of the effective area in the slip stream to the total area.

p is the ratio of the velocity in the slip stream to the air speed.

then

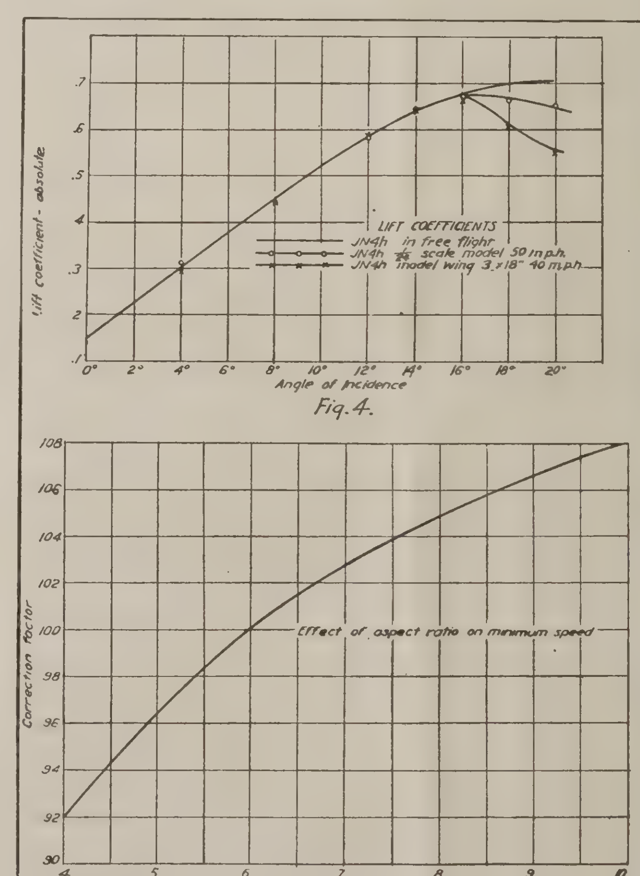
$$V = \sqrt{\frac{W}{A} \cdot \frac{1}{L_c}} \cdot \sqrt{\frac{1}{1 - mnp}}$$

The last radical contains only those terms affected by the slip stream. In Fig. 8 are plotted a few curves with various values of the constants m and n. On the usual tractor machine the percentage of effective wing area is very small, so that the reduction in speed from this cause is at most only a few per cent.

When an aeroplane is flying slowly with the throttle open (climbing) the thrust axis is inclined upward several degrees so that there will be a vertical component of the thrust given by:

$$Z = T \sin \theta$$

where T is the thrust and θ the angle of the thrust axis to the horizontal. It is possible to fly a powerfully controlled aeroplane at a very steep angle even when a constant altitude is



---

* N. A. C. A. Report No. 96.
** Bairstow—Applied Aerodynamics, p. 137.
*** Variation in Resultant Pressure Upon Landing Due to Proximity of the Earth. A. A. Memil—*The Ace*, December, 1920.
**** Bairstow—Applied Aerodynamics, p. 146.
***** Bairstow—Applied Aerodynamics, p. 141.

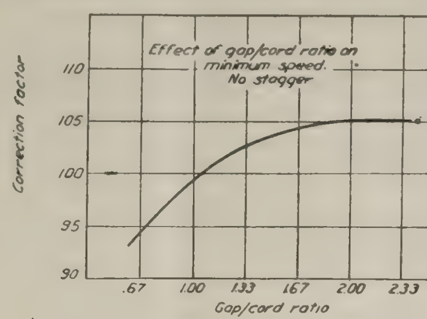


Fig.7.

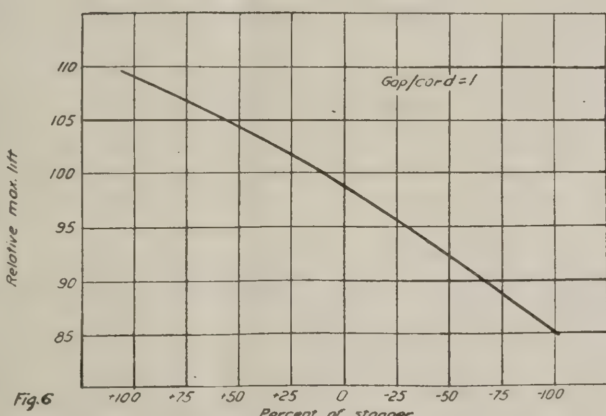


Fig.6

held. In Fig. 9 is plotted a curve showing the decrease in speed due to the direct lift of the air screw on a 2,000-pound machine with a 400-pound thrust. It is noticed that with a 20° inclination—the largest that is likely to occur—the decrease in speed is only 4%.

It may happen that on low-powered aeroplanes the minimum speed in level flight is determined by the engine power, that is, as the power increases with a decrease in speed for low speeds, the power may not be sufficient to allow reaching the minimum speed. This is shown in Fig. 10 for a JN4 with a 150- and a 90-horsepower motor; the latter power giving a minimum speed 3 m.p.h. greater than the former. In gliding flight this factor would not, of course, enter in.

Every pilot knows that it is necessary to hold the stick well back when flying at the minimum speed, and this is especially true in a glide when the elevators are not in the slip stream. In a great many machines the controls are pulled back to their greatest extent when flying slowly, and in such cases the longitudinal control is the limiting factor of the minimum speed. In the majority of the flying range—from 10 m.p.h. above the minimum to the maximum—the movement of the controls is very slight, but below a certain critical velocity the stick must be pulled back rapidly. This is shown clearly by a few control position curves from free flight tests plotted in Fig. 11.* It is also evident that as far as the longitudinal control is concerned a lower air speed can be obtained by an open throttle.

The reason for this break in the control position curves is due mainly to the fact that the center of pressure travel on the wing changes from an unstable to a stable direction at this speed; that is, at the lower air speeds the machine becomes very stable and attempts to nose down strongly, so that only a powerful tail force can hold it in slow speed equilibrium. There seems to be no way in which this break in the control position curve can be prevented, so that this factor imposes a serious obstacle to the safe and comfortable attainment of the lower speeds. All that can be done, and this is in other ways detrimental, is to use a powerful elevator, or a tail heavy and an unstable machine.

That the longitudinal control can have an important effect on the minimum speed was recently demonstrated on an experimental JN4h with a special tail to provide great stability. With this tail the minimum speed that could be reached was 50 m.p.h., while with the regular tail the minimum speed was 40 m.p.h., a very considerable difference.

We now come to the last and most important factor affecting the minimum speed, the lateral control. The lateral control is seldom associated with the ability to fly at very low speeds, but nearly every pilot will say that the reason he cannot fly more slowly is that the machine stalls, and a stall is falling into a side slip or spin because of the ineffectiveness of the ailerons and rudder. As the speed of an aeroplane approaches its minimum the action of the ailerons is seen to be very sluggish; in fact, if the stick is pushed sharply over the machine does not roll, but yaws sharply toward downward aileron. The ineffectiveness of the ailerons is shown very strikingly by a few curves taken from a model test** (Fig. 12). As the angle of incidence is increased the rolling moment grows smaller, becoming zero for no yaw at about 17° angle of attack, and at higher angles becoming negative. This means that at 17° the ailerons could not produce any rolling moment for this particular test, and the conditions would be nearly the same for any type of machine.

* N. A. C. A. Report No. 96.
** R. & M. No. 152, British Advisory Report.

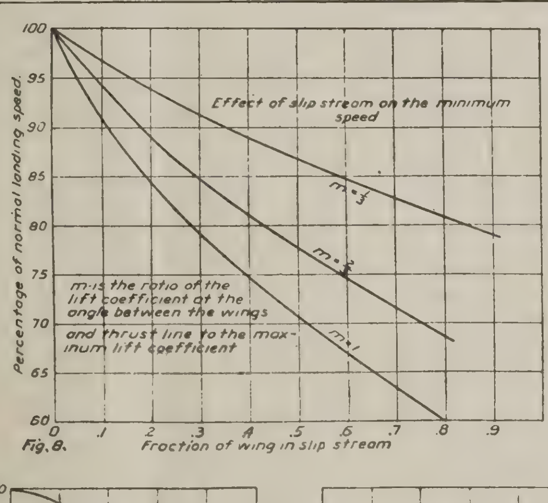


Fig.8.

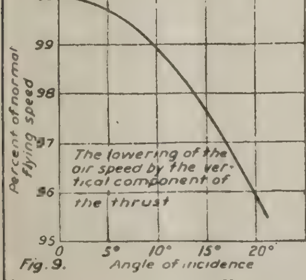


Fig.9.

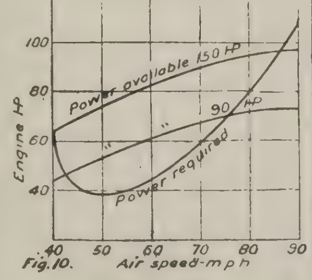


Fig.10.

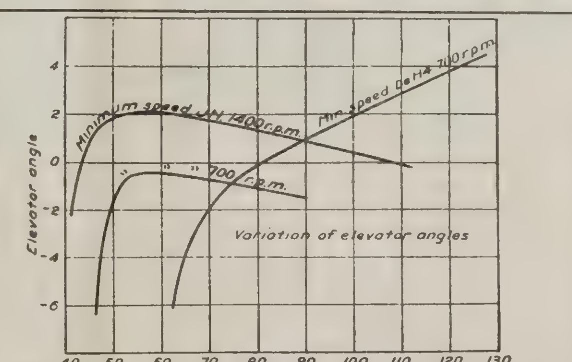


Fig 11.

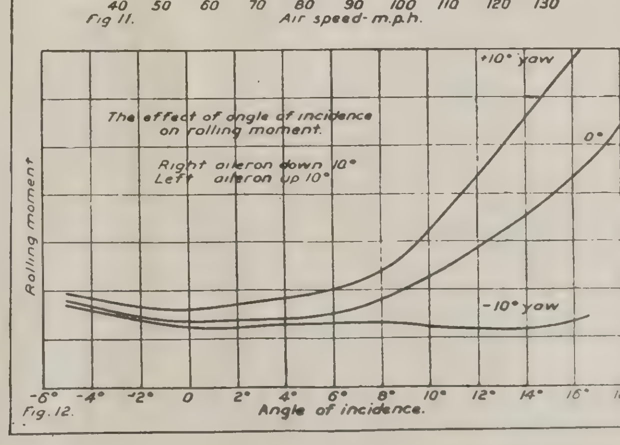


Fig. 12.

The other member of the lateral control, the rudder, is more effective at high angles of incidence than the ailerons and has the additional advantage of being in the slip stream, but it cannot directly produce a rolling moment. It is used, however, almost entirely to produce lateral balance by causing an angle of yaw which in turn produces a rolling moment as shown by the curves in Fig. 12. A pilot uses the rudder almost entirely when flying at very low speeds to keep his lateral balance, and the more skillful he is the slower can he fly without pulling into a spin.

The stalling speed of an aeroplane is usually not any definite figure for a certain machine but is a function also of the pilot. As an instance of this, a pilot was able to fly a certain machine no lower than 43 m.p.h. even after repeated trials; another pilot on the same machine and with the same weight, after considerable practice, was able to reach a steady speed of 40 m.p.h. because of his greater skill in using the rudder to prevent the machine from falling into a spin.

When designing a machine the preceding conditions for low speed should be considered, as they do not in general conflict with the other desirable properties. In particular, care should be taken to provide a powerful lateral control, as most pilots quite properly refuse to make full use of the low-speed properties of their machine because of the chance of pulling into a spin or sideslip. A great many crashes or landings can be traced to a lack of lateral control. Excessively large ailerons cannot be used on a high-speed machine because they are too stiff, that is, it is necessary to slow down before it is possible to go into a turn with any considerable bank, but it would seem possible to increase their efficiency without making them larger.

In conclusion, the following list of factors affecting the minimum speed of an aeroplane is given with the approximate magnitude of their influence in per cent based on the maximum variation of the factors that is likely to occur. The percentages given are of necessity quite arbitrary and are only intended in a general way to show the relative unimportance of all the factors except Nos. 1, 10 and 11. The wing loading is assumed to be specified and so does not come into the discussion:

1. Wing section—26%.
2. Wing loading—a given condition.
3. Aspect ratio—4%.
4. Gap chord ratio—4% (compared with monoplane).
5. Stagger—2%.
6. Scale—2%.
7. Slipstream on wings—1%.
8. Vertical component of air screw thrust—3%.
9. Power in level flight—5%.
10. Longitudinal control—20%.
11. Lateral control—15%.

The Aircraft Year Book for 1921

This, the first international yearbook of aeronautics, will be a necessity for all interested in aeronautics, for all libraries, and for all who wish information on this rapidly growing industry and science. It summarizes the development up to the present time and affords a running history of events. It will include: a summary of the year's advance in aeronautics; aerial transport in the United States and Europe; the complete history of the United States Aerial Forest Patrol; uses of aircraft at sea; aerial photography; gathering news by aircraft; the law of the air; airport and aerial communication; military and naval aeronautics; post-war governmental policies; complete chronolgy of aeronautical activities throughout the world; progress in construction of aircraft; a list of all officers on the aircraft division of the government service; a complete record of the International Aerial Convention; Aircraft Insurance; World Air Records; forty-five pages of designs showing the progress of American aircraft construction from the time the Wrights made the first flight. The information has been compiled with the support and encouragement of the various air services at Washington. Information from abroad has been obtained through European correspondents and the courtesy of the various Air Attaches of the United States or of the countries concerned. Special attention has been given to the section treating of aircraft design which is absolutely the first compilation of a historical record in the art.

Japan Buying Aeroplanes on Large Scale In France

Washington.—Japan's embarkation on an elaborate programme of naval aviation is to be expected, in the opinion of officials here, by the recent activity of its Government in purchasing aeroplanes in Europe and in enlisting the expert advice of British naval flyers.

The Japanese Government, according to reports here has ordered recently from France aeroplane equipment as follows: three six-passenger Spad type; fifty Breguet type equipped for day bombardment; ten Nieuport type double command, and twenty of similar type with single command.

In addition, the Government has begun the building of an aircraft carrier as an adjunct to the battle fleet capable of carrying thirty or forty planes. Completion this spring at Kasumigaura of a new aeroplane factory to equip the Japanese naval air service also is reported.

The Aviators' Ball

Among the patronesses of the Third Annual Aviators' Ball, which will be held at the Waldorf-Astoria on April 7th, are: Mrs. Cornelius Vanderbilt, Mrs. Edwin Gould, Mrs. Theodore Roosevelt, Jr., Mrs. George F. Baker, Jr., Mrs. George Jay Gould, Mrs. James B. Haggin, Mrs. Frederick Neilson, Mrs. Kermit Roosevelt, Mrs. John North Willys, Mrs. Edward F. Harkness, Mrs. T. J. Oakley Rhinelander, Mrs. Walter Jennings, Mrs. R. T. Wilson, Mrs. Rawson L. Woods, Mrs. Charles L. Lawrence and Mrs. Oliver Harriman.

Among the juniors, which is headed by Miss Symphorosa Bristed and Mrs. L. Gouverneur Morris, are the Misses Louise Vanderbilt Schieffelin, Eliza S. Parish, Consuelo Bettini, Betty Barber, Helen Cameron, Margaret Kahn, Sylvia G. Van Rensselaer, Madeline Liebert, Lucille Baldwin, Helena Ogden, Rita Boker and Mrs. Richard Emmet.

Among the patrons who will be present are: Air Commodore L. E. O. Charlton of the British Embassy, General Coleman du Pont, Mr. F. Trubee Davison, William W. Hoffman, Mr. Otto H. Kahn, Brig.-Gen. William Mitchell, Brig.-Gen. Douglas Mac Arthur, Superintendent of West Point; Phillip J. Roosevelt, and Robert D. Wrenn.

Examination for Aircraft Mechanical Superintendent

The United States Civil Service Commission announces an open competitive examination for mechanical superintendent (aircraft). A vacancy in the Naval Aircraft Factory, Navy Yard, Philadelphia, Pa., at $11.68 per diem, and vacancies in positions requiring similar qualifications, at this or higher or lower salaries, will be filled from this examination, unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer, or promotion.

Applicants should at once apply for Form 1312, stating the title of the examination desired, to the Civil Service Commission, Washington, D. C.; the Secretary of the United States Civil Service Board, Customhouse, Boston, Mass., New York, N. Y., New Orleans, La.; Post Office, Philadelphia, Pa.

Personal Par

P. L. Freeman who was manager of the America Trans-Oceanic Co. is now associated with Calvin Truesdale, Investment Securities, 120 Broadway, New York.

Conditions of Flight for a Hydroplane

This is an interesting mathematical comparison of the conditions of flight for an aeroplane and a hydroplane. The variation of the total resistance of the machine is studied in each case, and compared with the tractive force of the propeller, at the moment of taking off.

The subject is necessarily considered very superficially, and the hydroplane is regarded as consisting only of (1) the main planes (2) fuselage and (3) the floats of parallelogram form. (*L'Aerophile*, Dec. 1-15, 1920. 2 pp., 6 figs.)

Lubricants for Internal Combustion Engines

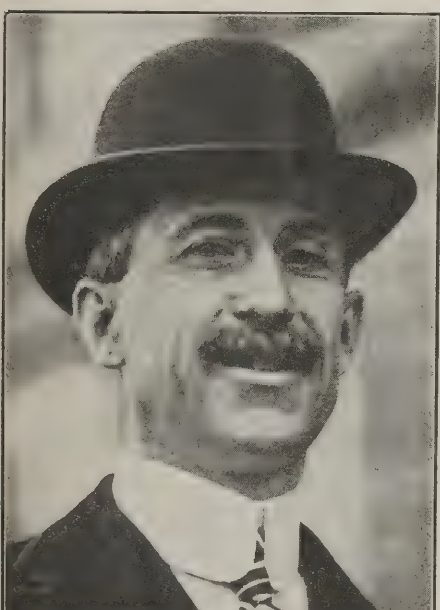
The author outlines the desirable qualities in a lubricating oil, with special reference to the high temperatures occurring in aeroplane engine cylinders, and the difficulty of observing and correcting faulty lubrication during flight.

The oil must be fluid at all temperatures, have a high flash point, must not decompose readily, and must have no solid matter in suspension. It must leave little deposit after burning, must not corrode metal surfaces, either ferrous or non-ferrous, and be dissolved as little as possible when mixed with petrol. After a brief reference to mineral oils, the properties and advantages of castor oil are dealt with in detail, and suggestions made for its adoption on all classes of petrol engines. The objections usually put forward, such as smell, gumming up, etc., are considered and mostly rejected.

Sources of supply are enumerated and prices given as 90 centimes to 1 franc 90 per kilogramme for first pressed oil, as compared with 60 centimes to 1 franc for mineral oils. At present castor oil is largely imported from the French colonies and India, but could be produced in many countries under favorable conditions.

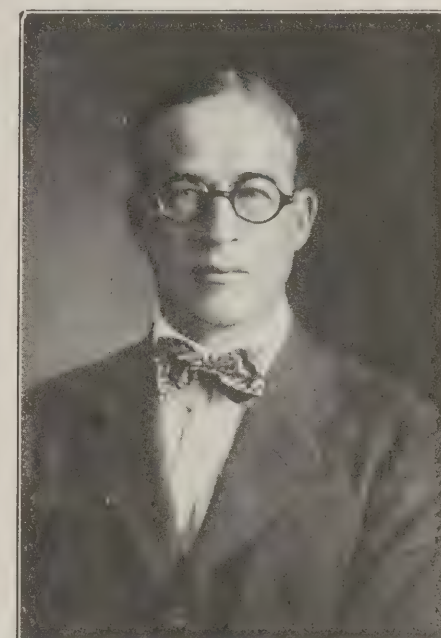
Methods of manufacture are described and tests for viscosity, purity, saponification, etc., are indicated. (Comm. Martinot-Lagarde, *L'Aeronautique*, Oct. 31, 1920. 7 cols.)

WHO'S WHO IN AERONAUTICS



Orville Wright

Inglis M. Uppercu



Frank H. Russell

Orville Wright

Orville Wright, the Father of American aeronautics, dates his interest in aeronautics as far back as 1899, at which time he and his brother Wilbur started work on the development of a heavier-than-air machine, which would be sufficiently mobile to permit of practical flying. Some of their first experiments were carried out at Dayton and others in Kittyhawk, N. C. The first actual heavier-than-air machine was a glider flown in the air in 1900 at Kittyhawk.

In 1903, the Wright Brothers developed a power machine having a span of 41 feet. Having been previously unable to secure a satisfactory motor, they invented and made one which met the requirements and which developed from 10 to 12 H.P. The weight of the machine complete with the operator was 750 pounds. This machine made the first flight in the history of the world at Kittyhawk, N. C. on December 17, 1903.

Having thus far succeeded, Mr. Wright directed his efforts to the improvement of both plane and motor until such time as the attention of foreign governments was attracted and he was given considerable moral and financial encouragement towards the carrying on of his work where previously he had met with little other than scepticism.

During the War, Mr. Wright gave the benefit of his consulting engineering advice to the Dayton Wright Aeroplane Company and numerous tests and experiments were carried out in his laboratories in Dayton leading to the adaption of many improvements in the present-day type of aeroplane.

Mr. Wright is still enthusiastically at work and it may be expected that improvements of far-reaching importance will yet be made by him.

Inglis M. Uppercu

Inglis M. Uppercu has had a pioneer's interest in aeronautics since 1908, and has been responsible, through his backing and his enthusiastic interest, for much that has been done in the way of aeronautic development. While essentially the business head of his Corporation, the Aeromarine Plane & Motor Corporation, he has always been a practical worker from the scientific standpoint. His plant of sixteen buildings at Keyport, and his fourteen hundred workers, did signal service for the Navy in the War, and he is now engaged in an even more important service to commercial aeronautics, for his organization has undertaken the important work of reconstructing the Navy flying boats, thereby making them adaptable for passenger and freight carrying purposes.

Out of the men who made—and retains—an important niche in the automobile industry, Mr. Uppercu has the energy and broadness of vision that are so essential to the success of American aeronautics.

Frank H. Russell

It was the whirr of more than wings which drew Frank H. Russell to his office window one autumn day in 1909. Wilbur Wright was flying from Governor's Island to Grant's Tomb in connection with the Hudson-Fulton celebration, and his humming engine it was which caused the president of the Hook and Eye Company of Hoboken to look towards and outward over the West River.

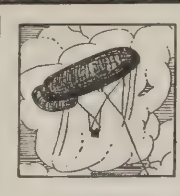
What he saw influenced Frank H. Russell profoundly. He felt an active interest in aeroplanes. And it was not long before he had managed, with the assistance of his cousin, Russel A. Alger, to meet Wilbur Wright. The meeting led to a connection on Mr. Russell's part with the Wright Brothers. He became in 1910 their first general manager—the first general manager, by the way, of an aeroplane company in America.

Mr. Russell had taken his A. B. from Yale in 1900, traveled a year in Europe, and served as sales manager for a newspaper manufacturing company in Canada until 1905, acting as United States Consul during the period. At thirty-one he was able to bring a varied experience, as well as an ample enthusiasm to his new and unprecedented position.

Service with the Wright Brothers was a step toward an interest in a company more his own. In November, 1911, Mr. Russell associated with Greely H. Curtis and W. Starling Burgess, became general manager of the Burgess Company and Curtis. In 1917 he became President of the Burgess Company. When the company was allied to the Curtiss Aeroplane & Motor Corporation he retained his interest in the Marblehead factory and became a director of the Curtiss Corporation. Soon, however, he shifted the emphasis of his work to the Curtiss Engineering Corporation as its vice-president and general manager.

When the Manufacturers' Aircraft Association was organized on July 24, 1917, Mr. Russell was chosen its president. He has had no small part in the rapid development of the Association.

Editorial note.—It will be the purpose of this department to acquaint Aerial Age *readers with the men who have contributed to the upbuilding of world aeronautics.*



FOREIGN TECHNICAL DIGEST

Bréquet "Leviathan"

Perhaps one of the most interesting commercial machines under construction at the present time is the "Leviathan" which is being built by the famous French firm "Bréquet." Very few details are as yet available, but from the brief description that is given in this article, it would appear that this machine embodies many of the features that will be included in the giant aerial liner of the immediate future.

The general dimensions are:

Span	25.538 metres
Length	14.106 meters
Height	5.135 metres
Lifting surface	134.70 sq. metres

It is a biplane of all-metal construction, with the passenger saloon built up in three parts, each part being detachable. A special room is provided in the nose of the fuselage for the engine installation, which consists of four Bréquet motors of 1000 h.p. One of the innovations is the reducer gear of the Bréquet type, which is fitted with an automatic connection and disconection, thus enabling a mechanic to shut off any engine and execute minor repair, without interfering with the functioning of the other motive power.

The weight of the machine empty is calculated to be about 2,600 kilos. After allowing for fuel for 10 hrs. flight, there remains a possible lift of 2,200 Kilos which may be used for carrying pilots, passengers, and goods. The total weight of the machine loaded is about 6,300 kilos.

("L'Aeronautique" January 1921)

Vickers' "Viking Mark IV"

The "Viking Mark IV" is the latest of the stages in the evolution of the Vickers amphibian aircraft. The first of this type (Mark I) was designed at the end of 1918 and during its tests it at once demonstrated that the designer had successfully solved the main problems of producing a machine capable of alighting or taking off at will upon either land or water. Various changes and improvements were made from time to time, until the "Viking Mark III" appeared in 1920 and won the first prize in the Air Ministry Competition for commercial amphibians.

The "Viking Mark IV" differs from the Mark III most noticeably in the fact that it is fitted with folding wings—thus effecting a considerable saving in stowage space.

In addition to this the span, and the wing surface, have been increased, the boat hull has an increased beam, and the controls have been removed from the front to the aft cockpit.

The hull remains in form and material similar to that of antecedent types. It is built of timber, planked with "Consuta." and fitted with two steps. The retractable under-carriage consists of two telescopic sprung struts, one at each side of the hull, pivoted at the upper end, and carrying landing wheels at the other end, which can be swung forwards and upwards about the top pivot by a pinion working in a rack forming a quadrant of a circle. The tail skid for land work is fitted at the rear step, and consists of an oleo-pneumatically sprung steel shoe, which also serves as a water rudder when afloat.

The wings are of biplane form, with a large dihedral angle on the bottom pair alone. The upper wing is in five sections, a centre section over the engine, an inner fixed section on each side, and two outer folding sections. The lower wings are in four sections, two fixed to the hull, and two folding outer sections. Outside the centre section struts there are two pairs of interplane struts per side, and folding occurs from the first of these pairs of struts.

Unlike the majority of folding wings, these are pivoted about the front spar, and fold forward, instead of backward. Owing to the necessary forward projection of the boat hull, this arrangement adds little or nothing to the overall length folded, and has the advantage that even a failure to lock the wings in their opened position cannot cause them to fold in the air.

Normally seats for five are fitted, two pasengers forward and one aft, with pilot and mechanic in the central cockpit. By removing three of these seats some 75 cubic feet of stowage space becomes available for cargo.

For warlike purposes it is obvious that the fore and aft cockpits may be made to bristle with guns, or may provide space for wireless gear and other necessary appurtenances.

With the modifications introduced the Mark IV has a capacity for 1,070 lbs. of paying load, as against 700 in the Mark III type, with only a very small drop in top speed and in climb, while the range of action remains unaltered. This refers to the type fitted with the Napier engine.

The Mark IV may be fitted as an alternative with the Rolls-Royce "Eagle" engine. Carrying the same useful load, the reduced engine power pulls speed and climb to some extent, but makes no appreciable difference to the range and cruising speed.

The main dimensions of this machine are:

Span	50 ft.
Chord	6 ft. 6 in.
Over all length	33 ft. 6 in.
Over all height (on wheels)	15 ft. 1 in.
Gap (at center line)	7 ft. 7 in.
Incidence of main planes	6 deg.
Dihedral, top plane	0 deg.
Dihedral, bottom plane	5 deg.
Loading per sq. ft.	9.4 lb.
Loading per h.p.	12.45 lb.

("The Aeroplane," 2nd Febry., 1921)

An Automatic Pilot

A new automatic device which it is claimed will not only relieve the air pilot of the strain upon his nerves in long distance flying, but will also be invaluable in heavy clouds or fogs, has been invented by M. Georges Aveline, a French engineer. The rights of this invention have been secured by Messrs. Handley Page, and this company has recently been carrying out a series of experiments with it. One machine, it is stated, having flown for two hours consecutively under the sole control of this device.

Briefly, it consists of the utilisation of compressed air combined with an electrical current. The air is automatically compressed by means of two small air pumps which are fitted beneath the forepart of the fuselage and are actuated by small air-propellers immediately the aeroplane begins its flight. The air is conveyed by tubes into an atmospheric reservoir fitted within the fuselage and is connected to a pressure gauge fitted in the pilot's cockpit, so that he can see at a glance that the necessary pressure of 60 lbs. to the sq. in. is maintained. Above the pressure gauge is a small electrical switchboard with a tiny lamp fitted to the right and to the left. The atmospheric pressure is conveyed by tubes to a circular tubular container half-filled with mercury, and so contrived that as the level of the fluid metal rises to the left or to the right with the movement of the aeroplane, so it causes a contact to take place which permits an electric current to act on valves, and they set in motion the mechanical gear connected with the pilot's controlling mechanism. Simultaneously the right or left lamp on the switchboard lights up, indicating the variation of the equilibrium, the current being shut off and the lamp automatically extinguished as the aeroplane is brought up to the correct level. By merely raising a small lever in the cockpit the whole of the mechanism is thrown out of gear and the pilot is free to take full control of the machine again. It has been tested under every conceivable circumstance with perfectly satisfactory results, and it is generally admitted by the many aviators who have had an opportunity of seeing the device in actual work that it opens up a new vista for aeroplanes, and brings within reasonable distance the time when it will be possible for private owners to fly their own touring 'planes with perfect security both by day and night. Meanwhile, it is interesting to record that the British Government has adopted the invention after most exhaustive tests, and that 14 Handley Page Bombers have already been fitted with it for the Royal Air Force.

("Aeronautics," 3rd Feby., 1921)

Lioré and Olivier Commercial Seaplane

Details are given of a six-seater commercial seaplane which has recently been constructed by the above French company.

It has three engines totalling 550 H.P. and at Villacoublay it came through its tests very successfully, where it climbed to 2.800 metres in 35 minutes.

The chief characteristics are:

Total length......M.	14 923
Maximum span	23 120
Total height	4 450
Surface: top plane......Sq. M.	49
Surface: bottom plane	58
Total surface	107
Horizontal empennage surface	10 200
Vertical empennage surface	5 44
Total surface of 4 balanced flaps	9,66

Engine-group

2 150 H.P. Hispano-Suiza engines.
1 260 H.P. Salmson engine, four-bladed propellers.
2 Lamblin radiators.
1 Honey-comb radiator.
Fuel for 4½ hours' flying.
3 Tractor screws.

Weight

Weight of the empty machine......Kgs.	2.789
Weight of fuel	650
Useful commercial load	600
Crew and accessories	321
Weight of the machine	4.360
Weight per H.P.	7 800
Weight per sq. metre	40 8
Factor of safety	6
Ceiling......M.	3.500
Ground speed......Kms.	140

(L'Air." French Aircraft Review. 1921.)

NAVAL and MILITARY AERONAUTICS

Appointments In The Army

There are more than 4,000 vacancies in the commissioned personnel of the Army. When promotions under the reorganization law are completed about 1,200 of these vacancies will be in the grade of first lieutenant, the remainder being in the grade of second lieutenant. While it is not proposed to fill all vacancies at present, the necessity for more officers for the Army requires that a portion of the vacancies be filled without delay. An examination will be competitive for 2,585 vacancies; the appointments to be distributed among the branches of the Army as follows: Infantry, 812; Cavalry, 35; Field Artillery, 600; Coast Artillery, 268; Engineers, 118; Air Service, 400; Signal Corps, 114; Quartermaster Corps, 35; Ordnance Department, 86; Chemical Warfare Service, 32; Philippine Scouts, 85.

As a result of this examination no appointments are to be made in branches of the service other than those named above.

Candidates for appointment in the Air Service, Engineers, Signal Corps and Ordnance Department are required to satisfy certain technical requirements, either by examination or by having graduated from technical schools.

March Field News

Numerous changes have been made in the Pilots' School Detachment. First Lieut. Chas. R. Melin is now the Commandant vice Major Clarence T. Tinker. The following named officers have been assigned to duty with the Detachment and placed in direct command of the various squadrons: First Lieutenants H. A. Dinger, Albert B. Pitts, Harold H. George and Richard J. Kirkpatrick and Second Lieutenants Chas. A. Horne, Milo N. Clark and John V. Hart.

R 38 Will Be Housed at Camp Kearney

The giant dirigible, now being built in England for the U. S. Navy, will be housed on a 1000-acre site at Camp Kearny, accordnig to a recent statement made by Congressman William Kettner of San Diego.

In a telegram to the San Diego chamber of commerce, Congressman Kettner stated that the purchase of 1000 acres at $100 an acre was included in the Naval Appropriation bill.

Sergeant Chambers Makes Record Parachute Jump

In a De Haviland 4B aeroplane, piloted by Lieutenant Paul T. Wagner, the world's altitude record for parachute jumping was broken by Sergeant Ensel Chambers at Post Field on Washington's Birthday. At 1:45 the plane carrying Sergeant Chambers as passenger took off and gained an altitude of 22,200 feet above sea level at 2:45 P. M. Lieutenant Wagner was beginning to feel the effects of the rarity of the atmosphere and lack of oxygen at that altitude and turned to Sergeant Chambers and suggested that the jump had better be made. The sergeant was rather weak and had difficulty in climbing from the cockpit with the two 'chutes on his back, but after several attempts finally succeeded in getting in position to jump. When he was ready he nodded to Lieutenant Wagner to stall the plane and Sergeant Chambers dropped off into space. Due to extreme cold and weakness from lack of oxygen, Sergeant Chambers could not function his arms properly and had great difficulty in opening the 'chutes. It is believed that he fell at least 1,500 feet before he finally succeeded in pulling the wire so that the 'chute could be released. A stiff wind from the north was blowing and carried him 15 miles southeast of the point from which he left the plane. The landing made was especially fortunate in that there were no obstacles nor barbed wire fences within a half mile, as the wind dragged Sergeant Chambers at least a half mile before he finally succeeded in cutting the 'chutes loose from his harness. Neither Sergeant Chambers nor Lieutenant Wagner felt any ill effects from the trip.

Air Service Mechanics School Moves from Kelly Field to Chanute Field

Special Order No. 3, Paragraph 2, Headquarters 8th Corps Area, dated January 4, 1921, directed Air Service Mechanics School to proceed from its present station at Kelly Field to Chanute Field, Rantoul, Illinois, on or about January 15, 1921.

Instruction was carried on until January 14th, when packing commenced. It took 90 cars, a train just one mile long, which was divided into four sections, to haul the equipment of this school. Not one of these cars was left "spotted" at either Chanute Field or Kelly Field more than 36 hours for the entire process of loading or unloading. Not one piece of freight of any kind was damaged en route. There was no sickness, no cases of disciplinary action of any kind during the entire move.

The personnel was moved in three sections, the first troop train leaving January 27th, the second February 19th, and the third February 23d. The personnel of the Air Service Mechanics School now consists of 27 officers. 1 warrant officer, 659 enlisted men (permanent personnel and students) and 120 civilian employees, 76 of whom were transferred from San Antonio, Texas.

The move was commenced January 27th and ended February 25th, with the arrival of Major Stratemeyer, the commandant, at Chanute Field.

The equipment for instruction will all be installed, every necessary alteration made, and instruction in every department functioning at capacity by April 15th.

A favorable sentiment toward conditions of this field is universal throughout the command, with the exception of the wives of some of the officers, who have battles of their own learning the cooking combinations of the coal stoves of this field. Even along this line, however, matters are progressing favorably, and the morale throughout the school promises to be much higher than heretofore.

Up to February 25th Chanute Field was commanded by First Lieutenant Langhorne W. Motley. On his arrival from Kelly Field, Major Geo. E. Stratemeyer officially took command of the station. Lieutenant Motley will now be executive officer.

Flying has been carried on since the first of February at this field, conditions in this locality being very favorable for any class of flying.

List of Officers from Foreign Countries Taking Flying Training at U. S. Air Service Schools

Below is a list of officers from foreign countries who are taking training at U. S. Army Air Service schools:

Lieut. Carlos Gilardi, from Peru.
Lieut. H. Zuniga Cooper, from Chili.
Lieut. J. Arvalor Garrasco, from Chili.
Miguel G. Granados, from Guatemala.
Capt. M. Arozarena, from Cuba.
2nd Lieut. Eddie Laborde, from Cuba.
Lieut. Humberto Teran, from Ecuador.
Lieut Guillimo Freile, from Ecuador.

Lieut. Guillimo Freile has recently been transferred to A. S. Mechanics School.

Request has been made for transfer of Lieut. Humberto Teran to Photographic School at Langley Field, Hampton, Va.

Request made for Ensign Victor M. Padula and Silvio Leporace of the Argentine Navy to be given flying training at Carlstrom Field and for Leriere Bastos of the Portuguese Army to be given one month's training at Engineering School, Dayton, Ohio.

Radio Controlled Torpedo Boat To Be Constructed

The U. S. government has, after several months' debate, decided to construct a Hammond radio controlled torpedo boat for practical test of the radio controlled principle, and the new vessel if built as designed, will be propelled by a gasoline engine of 1600 horsepower.

The torpedo, which will be installed in the bow of the new vessel, will contain 1500 pounds of high explosives, and will, of course, be controlled in its movements from the shore.

The total cost of the new craft will be about $373,000, divided as follows:

Engines and gear, $170,000; hull and accessories, $100,000; radio dynamic features, $45,000; auxiliaries and tests, $58,000. The speed of the little vessel will be about 35 nautical miles per hour.

The National Southern Air Tournament

A 100-mile free-for-all race will be flown over a triangular course of about 20 miles on March 27, 1921, at Belleaire Heights, Florida. The referee and starter will be Major Ralph Royce, U. S. A., Commandant, Carlstrom Field, Arcadia, Fla. All entrants will be Army pilots. The prizes will be trophy cups donated by Mr. Bowman, Mr. Carley and others. The admission to the public is free. This tournament will consist of this race and a program of formation flying, parachute drops and stunts, also exhibitions for seaplanes will be given.

FOREIGN NEWS

German Aeronautical Material at Antwerp

In view of inaccurate statements which have appeared in the press regarding the receipt, examination and disposal of German aircraft, engines and other aeronautical material assigned to Great Britain under the terms of the Peace Treaty, the British Air Ministry makes the following announcement:

Aeronautical material surrendered by Germany under the terms of the Peace Treaty is collected by the Inter-Allied Aeronautical Commission of Control, which arranges for its allocation to the various allied powers.

The material allotted to Great Britain is dispatched by rail to Antwerp in sealed cases, which are opened in the presence of Belgian officials. The material is taken in charge by the Royal Air Force Port Detachment, and is carefully surveyed by special officers of the Research Department of the Air Ministry, who select those articles which appear to be of technical or scientific value.

The Air Ministry is also informed direct by the Inter-Allied Aeronautical Commission of the material which will arrive at Antwerp so that the Director of Research may be fully informed of the position.

No material is considered surplus until it has been carefully inspected and rejected by the special technical officers of the R. A. F. A further survey is then made for articles suitable for war trophies and museum exhibits.

All material selected is shipped to the Royal Air Force experimental stations, where a considerable amount has already been collected and is now undergoing the most minute inspection and test at the hands of experts. Several machines of various and important types are expected to be ready shortly for actual flying trials in the air. Many types of aero engines are at present undergoing running tests on the bench, and it is anticipated that very complete data will be available as a result of the experiments conducted upon them.

All supplies of the special types of Maybach engines required for the purposes of research are being transhipped from Antwerp to the experimental stations in England.

The material remaining at Antwerp, after the process of selection, is handed over to the Disposals Board of the Ministry of Munitions. In accordance with the orders of the Supreme Council no aeronautical material received from Germany may be disposed of unless it is reduced to scrap. This surplus material will therefore be reduced by the Disposals Board "in situ" and sold locally. Hitherto, however, no reduction has taken place, as the arrangements of the Disposals Board are not yet completed.

It has been decided that the reduction and consequent sales should take place in Antwerp, first to save the cost of shipment to England, and secondly to meet the views of the Society of British Aircraft Constructors with regard to the introduction of German material into this country.

No stores have been tampered with while in transit to Antwerp, but thefts of material are known to have occurred at earlier stages. In all cases the stolen articles have been of little commercial and of no technical value. It is also certain that pilfering took place during the period between the Armistice and the institution of the Aeronautical Commission.

The work of the Inter-Allied Aeronautical Commission is still proceeding and full advantage is being taken by the Air Ministry of the material allotted.

Japan Organizing Aerial Naval Forces

Orders have been given to carry out the plans to give the Imperial Japanese Navy aerial eyes by placing aboard every naval vessel as much aircraft as each vessel is able to accommodate and launch from its decks. Base aerodrome operations will be conducted from Oihama (near Yokosuka), Kure, and Sasebo. A large number of pursuit, observation and bombing squadrons are about to be assembled at these bases. Every effort is being made to put the aircraft factories at the Imperial Naval Dock Yard at Yokosuka and Sasebo in efficient condition, and also the aircraft engine factory of the Mitsubishi shipyard (Kobe), the aircraft factories at Kawasaki shipyard (Kobe), and the aircraft factory at Ootamachi are being put on a better production by the time the thirty British naval instructors arrive from England in the early part of April. Sasebo will be the main general supply base for equipping the warships with aircraft. Large quantities of spares and planes will be kept on hand at this base. The larger vessels will be equipped with both seaplanes and land machines, the land machines will be of the pursuit type and will be launched from the deck or gun platforms. It is desired that aviation be developed to such an extent that it will rank with the foremost aerial fleets of the world.

Spanish Subsidy for Air Lines

It is reported that the Director-General of Posts in Spain is inviting applications for the operation of the Malaga-Melilla and Seville-Larache air lines under the following conditions:

(a) Malaga to Melilla.—(1) The contractor to receive a State subsidy up to a maximum of 5 pesetas per km. for flights actually carried out. (2) The contractor to maintain the aerodromes of Malaga and Melilla. (3) State subsidies can only be obtained for a maximum of 6 hydroaeroplanes only, with an average speed exceeding 150 km.p.h., and capable of transporting 300 kg. of mails. The contractor must have 50 to 100 engines, spare parts, and a factory or workshop. (4) Duration of contract, 4 years.

(b) Seville to Larache.—The same conditions apply for this line except that the State subsidy in this case is 6 pesetas per km., and that maintenance of aerodromes and workshops is charged to the State. This line must be operated by land machines.

Prospects in South Africa

Interviewed in London prior to his departure for the Cape, on January 7th, Colonel Sir Pierre van Ryneveld, the hero of the Cairo-to-Cape flight, said that the South African air services would be organized on an important scale.

There was a gerat future for the air services, both military and civil, in South Africa. Thanks chiefly to the generous gift of the Imperial Government, Pretoria would shortly have one of the finest aviation workshops in the world, and through the Imperial Government they would have enough work for two years.

He expressed the opinion that there was a big scope in South Africa for government work by aviation, particularly in connection with aerial surveys. The experiences gained during the war in this connection will be most valuable and most helpful in the future. In regard to postal services, Colonel van Ryneveld significantly remarked that Pretoria was only one day's journey by air from Capetown, Bloemfontein, Durban or Windhuk.

It was easy to draw one's own conclusion what that meant in cases of urgent official or other communications and what a national service it might be.

Around the World Race

A Capetown correspondent writes to *The Motor Weekly* that "It is a pet ambition of the Bros. Solomon to compete in the 'Round the World' air race. The contest, it will have been noted, takes place on any selected dates during the last six months of this year at the option of the competitor. I am told that if £10,000 can be subscribed in South Africa this would enable a suitable machine to be procured and manned, and cover the host of incidental expenses incurred in mapping out such a long course and providing against every reasonable contingency en route. That South African pilots would be able to show up conspicuously in competition with contemporaries, given equal facilities, need not be doubted, and one hopes that the Aero Club of South Africa will interest itself sufficiently in the project to ascertain if wealthy South African sportsmen cannot be found to give the scheme practical support."

It is expected that some interesting information regarding this race will be announced at an early date.

Aero Club of Canada Seeks Larger Accommodation

The directors of the Aero Club of Canada are busy investigating several propositions with a view to providing more adequate quarters.

The present quarters consist of lounge and dining room, with billiard tables, etc., all in one large room. It is now sought to obtain more accommodation, having, if possible, separate rooms for lounge, dining, billiards, cards, writing, etc., with the addition of bath, showers, and bedroom accommodation for out-of-town members. The probability is that the directors may prepare a scheme in the near future in which the members will be invited to invest.

There appears to be a very healthy determination on the part of the directors and members to see the Aero Club of Canada settled in a building of their own.

Prince of Wales Becomes Hon. President Aero Club of Canada

At a meeting of the directors of the Aero Club of Canada, held on February 18, the president announced that H.R.H. the Prince of Wales had written consenting to become Honorary President. The recognition of the club by His Royal Highness has been received with much pleasure and appreciation.

Pacific to Amazon Air Route Reconnaissance

In a lecture before the Royal Geographic Society, London, G. M. Dyott, late Squadron Commander, R.N.A.S., gives an interesting account of a mission undertaken by him for the purpose of making preliminary survey of an air route from the Pacific Ocean to the Amazon River.

"My journeyings" said Mr. Dyott "were not undertaken primarily with a view to acquire geographical knowledge, although I must admit that it was lack of such information that made it necessary for me to travel as extensively as I did. The chief motive was to see if it was not possible to establish an aerial route that would connect the Pacific coast with the town of Iquitos, the inland port of Peru, situated some 2,147 miles up the Amazon. The net result of my observation was that no particular technical difficulties lay in the way of carrying out such a scheme; in fact, of all the world routes which are being discussed at the present time, I think few offer less difficulties or greater advantages. Even if private capital could not be induced to inaugurate an air service through the wilds of the country, the Government of Peru itself could well afford to carry out the project simply as an insurance against loss of valuable territory, quite apart from any of the obvious commercial advantages which would be derived from it.

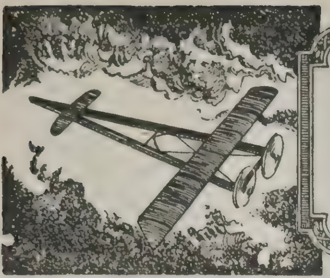
For many years the question of a trans-continental highway of some kind through the region traversed by Mr. Dyott has been under discussion, but the initial cost of a railway has been, so far, prohibitive, and a mountain trail would be wholly inadequate. The latest estimate submitted to the Peruvian Government for a railway over the Paita-Maranon route was £9,000,000, and it was stated that as no return on the investment could be expected for at least twenty years, a guarantee of 7 per cent interest would have to be made by the state for that period of time. In comparison with the above figures, Mr. Dyott asserts that a rough estimate of outlay for an air service capable of making three trips every fortnight in either direction would be £150,000. While this is, no doubt, a conservative figure, were it increased to £500,000 it would still leave a wide range of speculation between this and the estimated cost of the building of the railway, in which calculations should be taken into consideration the suggestion that once the country is explored for the air route, and as a consequence to a certain extent opened up and settled, a railway could follow with some assurance of finding a sufficient volume of traffic at the commencement to justify the expenditure of large capital.

The topographical configuration of Peru is peculiarly suitable for aerial transportation, not because distances are great, as in the Argentine, but because the obstacles encountered in traversing the relatively short distances are colossal. Range after range of mountains intervenes between the coast and the Amazon with its many tributaries, and even when the flat land of the river valley is reached after weeks of mountain climbing, the traveler finds his way blocked by weary miles of almost impenetrable forest.

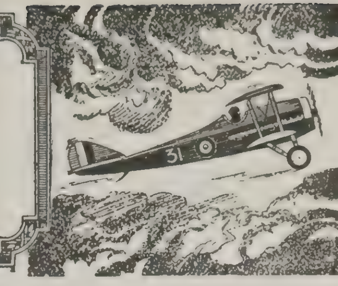
Four routes were surveyed by Mr. Dyott from the Peruvian Coast to Iquitos and his choice, from the point of view of commercial air transportation, was the route Paita or Chiclayo to Bellavista and thence by the Maranon River to Iquitos.

Great Britain's Eastern Aerodromes

The Air Ministry of Great Britain has secured, on the England-Egypt Commercial route, a site at Malta for a new aerodrome, and steps have been taken to ensure wireless communications along the line between England, Malta, Egypt, Mesopotamia and India. Arrangements have also been made whereby the maintenance of the aerodromes on the Cairo-Cape Town route will be borne by local governments, thus relieving the British Government of financial responsibility of these matters in future.



ELEMENTARY AERONAUTICS *and* MODEL NOTES



CLUBS

PACIFIC N.W. MODEL AERO CLUB
921 Ravenna Boulevard, Seattle, Wash.

BAY RIDGE MODEL CLUB
8730 Ridge Boulevard, Bay Ridge, Brooklyn

INDIANA UNIV. AERO SCIENCE CLUB
Bloomington, Indiana

BROADWAY MODEL AERO CLUB
931 North Broadway, Baltimore, Md.

TRIANGLE MODEL AERO CLUB
Baltimore, Md

PASADENA ELEM. AERONAUTICS CLUB
Pasadena High School, Pasadena, Cal.

NEBRASKA MODEL AERO CLUB
Lincoln, Nebraska

BUFFALO AERO SCIENCE CLUB
c/o C. Weyand, 48 Dodge St., Buffalo, N. Y.

ILLINOIS MODEL AERO CLUB
Room 130, Auditorium Hotel, Chicago, Ill.

SCOUT MODEL AERO CLUB
304 Chamber of Commerce Bldg., Indianapolis, Indiana

MILWAUKEE MODEL AERO CLUB
455 Murray Ave., Milwaukee, Wis.

CONCORD MODEL AERO CLUB
c/o Edward P. Warner, Concord, Mass.

MODEL AERO CLUB OF OXFORD
Oxford, Pa.

CAPITOL MODEL AERO CLUB
1726 M St., N. W., Washington, D. C.

AERO SCIENCE CLUB OF AMERICA
Beach Bldg., E. 23rd St., New York City

AERO CLUB OF LANE TECH. H. S.
Sedgwick & Division Sts., Chicago, Ill.

LITTLE ROCK MODEL AERO CLUB
1813 W. 7th St., Little Rock, Ark.

Dr. S. P. Langley's Early Experiments

THE story of Samuel Pierpont Langley's study and experiments in connection with aeronautics begins in 1887, some years before serious-minded people considered aerial navigation practical with machines heavier than air, and this study extended over sixteen years. During that time Langley established and successfully demonstrated many principles which have since proven invaluable to the science of aviation.

The principal object Langley had in mind was to establish by experiment the possibility of and the conditions necessary for transporting a body heavier than air through that medium. He began with studies of model aeroplanes propelled by rubber bands, which led to more elaborate experiments with planes, propellers, steam and gas engines and other accessories, and to his final experiments with a man-carrying machine driven by a gasoline engine which is considered remarkably efficient for that time. In his first experiments he met with many discouragements, but his persistency led finally to those results which entitled him to be called "The First Bird Man."

Results of these experiments were printed in popular forms in several magazines and periodicals, while his technical scientific reports were issued by the Smithsonian Institution during his term as its Secretary, from 1887 to 1905. His first real contribution to the science of aeronautics was entitled "Experiments in Aerodynamics," published in 1891, which covered his physical researches and showed that the pressing problems of aviation were those of guiding and elevating a plane rather than of supporting it. Langley had already established the possibility of the latter by means of his suspended planes, the plane dropper and other special apparatus.

Langley's second aeronautical treatise was on the "Internal Work of the Wind," published in 1893, in which he pointed out the various internal forces of the atmosphere upon which objects might rely for support apart from their own power. In 1911 a complete and detailed account of his investigations relative to the models and the large machine was issued under the title of the "Langley Memoir on Mechanical Flight."

Having secured a grasp upon the fundamental principles of air resistances, and matters relating to aviation generally, Mr. Langley undertook the machine in 1892. He felt that it would be impossible to conduct further investigations of flight without studying flight itself. The first model was completed after four years of experimentation. It was a steam-driven machine with two sets of monoplane wings arranged in tandem, and a tiny steam plant which weighed only 7 pounds complete and yet developed 1¼ horsepower. The wing spread was 13 feet and the weight 30 pounds. Many boilers, burners and frames were built and discarded before the model was finished, and then the problem of launching it confronted him. This was finally accomplished by means of an overhead track from which the model, when ready to fly, was shot into the air by a series of springs.

On May 6, 1896, the first successful flight was made at Quantico, on the Potomac River. The flight occupied 1 minute and 20 seconds, during which time the little machine covered a distance of 3,000 feet. It was again flown and a flight of 2,300 feet made. These were the first flights of a machine heavier than air propelled by its own power ever made in the history of the world.

Models Built by Aerial Age Readers

After an exhaustive study of plans and specifications of the S.V.A. aeroplane, Mr. Landon Burt, a member of the Capitol Model Aeroplane Club, has completed a faithful copy of the famous Italian fighting machine, executed at a scale of 1 inch to the foot.

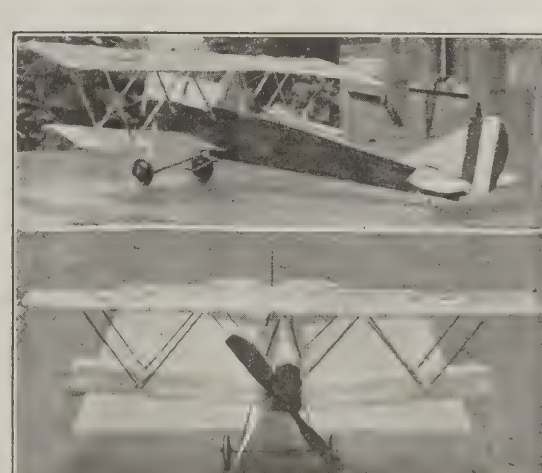
It embodies the following construction: veneer fuselage, aluminum cowling, streamlined rubber-tired disc wheels. Wing section and propeller accurately scaled; frames of fuselage built up. Supporting surfaces include the full complement of ribs and struts, the ribs being built up as in the prototype with portions cut away to lighten. The interplane and landing gear struts are of light tubing and the lower longerons converge in the rear of the pilot's cockpit, giving a triangular cross-section at the rear of the fuselage. Cables are equipped with turnbuckles.

General Dimensions

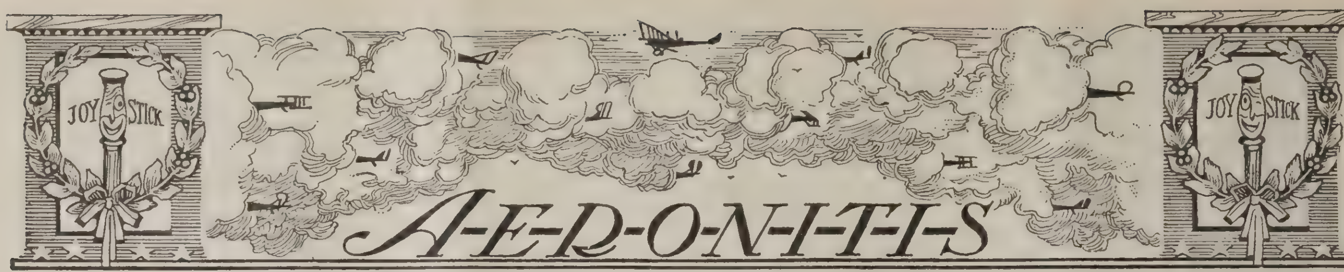
The general dimensions of the little machine are as follows:

Span, upper plane	30 1/6"
Span, lower plane	25"
Chord, both planes	5 5/12"
Gap, at body	5 11/12"
Gap, at wing tips	4 11/12"
Length overall	26 7/12"
Height overall	10½"
Propeller diameter	9"

The machine is decorated with its national markings, presenting a pretty appearance. Mr. Burt attributes his success in model aeronautics to a constant perusal of the "Elementary Aeronautics Page" of AERIAL AGE and to his association with the Capitol Model Aeroplane Club.



The S. V. A. Model built by Landon Burt



A Flight of Aeroplanes

Great, wondrous birds with giant outstretched wing,
Come swiftly darting into sight,
And thrumming, whirring bring;
They skim the clouds and wing the blue,
As some fierce eagle might,
Then lo! they lift and seem to fly—
Straight to the Gates of Light.

MARTHA MELLEN.

The Airways

Highway and byway, dusty and muddy,
Using and wearing our youth and old age.
Alleyway, pathway, rough and forbidding,
Wearing and tearing our lives in their rage.

But oh! the clean Airways, kind guiding stairways,
Gentle, soft Airways, they serve us for aye.

Subway and railway, dark, damp and dismal,
Gasping and roaring in nerve-racking storm;
Streamway and seaway, restless, complaining,
Rising in threatening, menacing form.

But oh! the great Airways, unwearying stairways,
Their soft eager bosoms upbear us for aye.

Trolley and tramway, clanging, mechanical,
Avid and sordid, belching with dust;
Creek and canalways, muddy deserted,
Destruction lurking worthless of trust.

But oh! the long Airways, the lasting, long stairways,
The soft yielding fairways, they bear us for aye.

HAROLD A. DANNE, in the *N. Y. Times.*

Greenhorne—I've just been reading that the aviators to-day can do anything a bird can do! Yes, sir; they've got the thing down so fine that there isn't a bird alive that has anything on them.

Lieutenant Groah—"Zatso? Well, when you see an aviator fast asleep, hanging onto a branch of a tree with one foot, then I'll come and take a look.

"Who won the war?" asked the wise Young Goof behind the soda fountain.

"Huh," ejaculated Lieut. Tommy Potter, gruffly, as he dug up the war tax, "I think we bought it." H. J. J.

"Doctor," said Lieutenant Flyte, 'I am a victim of insomnia. I can't sleep if there's the least noise, such as a cat on the back fence."

"This powder will be effective."

"When do I take it?"

"You don't. Give it to the cat in some milk!" H. J. J.

Jimmy had a Thomas cat,
It warbled like Caruso;
A neighbor heaved a baseball bat—
Now Thomas doesn't do so.

H. J. J.

The Pilot

Oh! high I rise in the morning,
High up in the clouds so blue,
To see the sun brightly shining
On the clouds of so many hues.

I swirl and dine 'mongst the glitter
Of sparkling dewdrops fair,
And glide and sail and flitter
Alone high up in the air.

I glide and sail o'er the mountains,
With my heart near bursting wide,
Thinking of nature's great fountains
She never from me can hide.

Oh! how I wish I could see
Each man and woman and child
Sailing high, in this beautiful sea,
Casting off their burdens and trials.

To man our God is giving
The power to fly in the air,
So let us enjoy God's blessing
And sail in the heavens so fair.

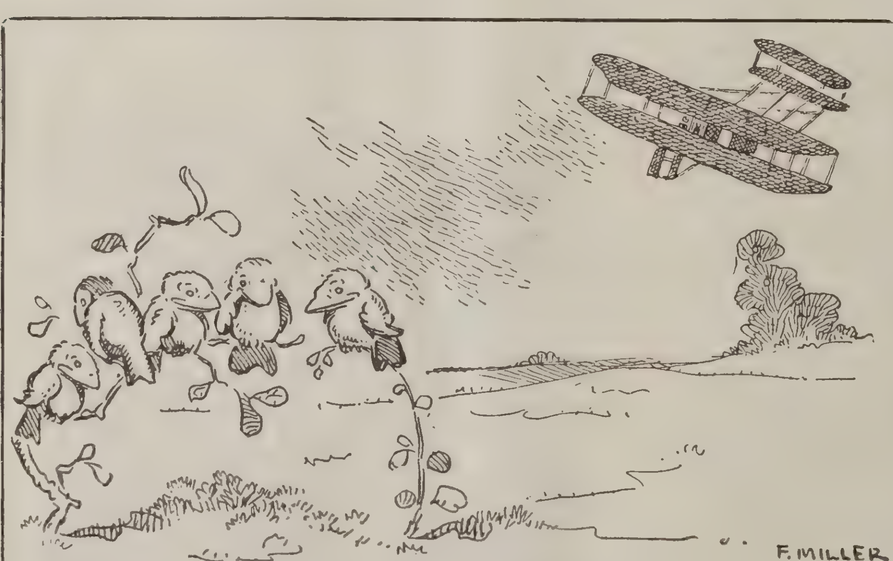
C. LA VETTE STAYTON.

Former aviator who robbed the mail on the Burlington has gone up—for fifteen years.

A group of aerial tourists were looking over the inferno of Vesuvius in full eruption.

"Ain't this just like hell?" ejaculated a Yank.

"Ah, zese Americains," exclaimed a Frenchman, "where have zey not been?"



CAUGHT ON THE WING.
"The human race is still in its infancy."
"Sure! Just learning to use its wings."

New Kings for Old

Suffer not the old kings,
Let their fame depart;
We shall have a new breed
Of the eagle heart.

They shall shine with valor,
They shall greatly dare,
They shall live with venture,
They shall ride the air.

They shall launch new navies,
Riding safe at ease,
High above the tempest
On the shoreless sea.

No, nor weary marches
Shall distress these kings,
They shall span high arches
On triumphant wings.

They shall rule in kingdoms
Where no man has trod,
Theirs the Winged Victory
On battlefields of God.

MABEL K. RICHARDSON.

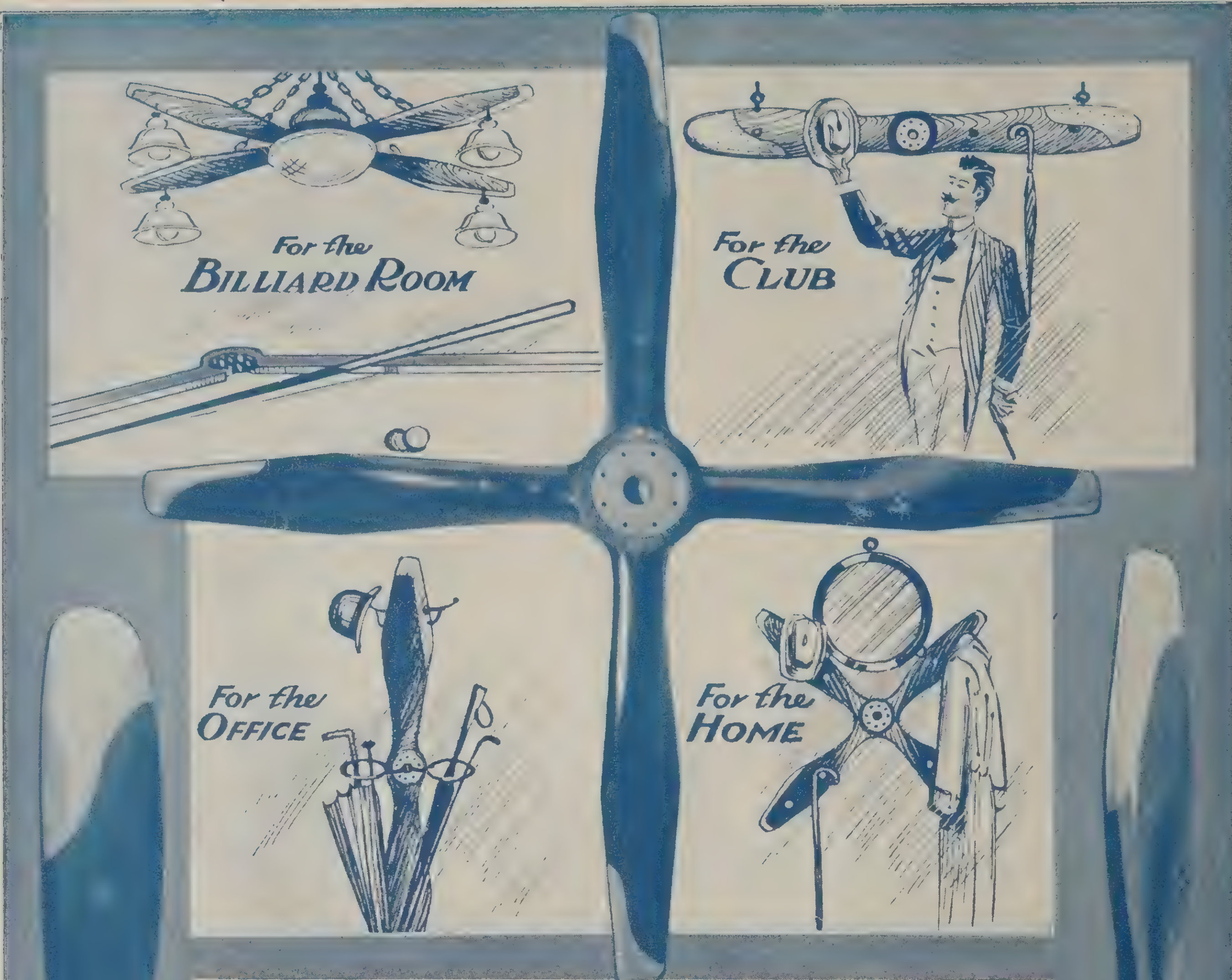
AERIAL AGE WEEKLY

OL. 13, No. 4 APRIL 4, 1921 10 CENTS A COPY

A Martin Bomber Over the Battleship Pennsylvania. Will Congress Heed the Warning?

Europe's Way With Flying

UBLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
ubscriptions: Domestic, $4; Foreign, $6. Entered as second-class matter March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879



For the BILLIARD ROOM
For the CLUB
For the OFFICE
For the HOME

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

LESLIE V. SPENCER, M.E.
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of
Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL
TECHNICAL, ENGINEERING AND TRADE
AUTHORITY

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIII | NEW YORK, APRIL 4, 1921 | NO. 4

EUROPE'S WAY WITH FLYING

GREAT BRITAIN has decided, publicly at least, that the basis of her one-power navy is to be the capital ship. Still it is important to note that she is spending aproximately $73,614,000 on aviation in 1921. Of this, $3,525,000 is devoted to the encouragement of civil aviation and $6,824,000 to research. The only parallel in the American budget to the first item is the $1,250,000 which was voted for the air mail, yet the London Times is greatly excited over French competition in civil aeronautics.

"The French believe," it remarks, "that air power in time of peace is best won by allocating an appreciable percentage of their total vote to the development of civil aerial transport. News reached London yesterday that they have now decided definitely to spend approximately £3,400,000 at the present rate of exchange (or of over £7,000,000 at the normal rate) on purely commercial flying during the coming year, and that it has been agreed without question to allocate slightly more than £600,000, at the present rate of exchange, to the direct subsidy of their air lines."

This news, the Times believes, warrants a new British subsidy to the London-Paris air route, though it already is encouraged to the extent of $240,000 a year. This morning brings the news that the Air Ministry, short of funds to maintain all its 'planes and dirigibles in service, has offered ten of the latter free to private companies wishing to operate them. The gift, if accepted, represents a subsidy of $12,000,000. Meanwhile, German writers are urging a comprehensive effort for the creation of a great German commercial air industry. "During the next few years," says a writer in Der Luftweg, "aerial transport will need the support of state subsidies, but it will gradually be enabled to stand upon its own feet by progress in the technics of aeronautics and through the enlistment of the sympathy of the economical classes." Lines running throughout Germany and into contiguous countries are advocated.

The significance of this news is too apparent to one who has followed the American policy toward aviation. European nations are not only spending more money than we on aeroplanes, but they are spending it sensibly and with an intention to develop an industry as well as military air forces. The real efficacy of the latter, of course, depends on the former. In the United States, on the othr hand, flying has been a sort of gutter-child, finding its food where it could and at times almost failing to find any. At present we are sinking from a brief but brilliant aerial activity into the state of official indifference from which we emerged in 1917. We have not entirely given up the idea of American flying, but we have shown a lethargy and bewilderment concerning it. The need is chiefly one of preserving the factories that make the planes and the engineering forces that design them. These, tided over a few years, should be self-supporting. It is astonishing that, faced with the alternatives of a crippled industry and a modest study of and action upon the problem, we seem drifting toward the former. Flying, with its great industrial potentialities, is far more than a branch of the military service. It should get something of the serious attention here that is being given it in Europe.—*Editorial in N. Y. Globe.*

Gowns Fly the Channel

THE possibilities of commercial aviation under favorable circumstances are indicated in a report made by the Department of Commerce on British aerial trade in 1920. The United Kingdom imported articles valued at £667,047 and exported articles valued at £339,108, an aggregate of more than a million sterling.

Nearby France was of course the principal market. The leading items in the British aerial import list are women's clothing and furs. Of these £385,000 worth were sent from France by air. They were light, costly and needed quickly—three points which aid in the flying freight business.

Woman's wishes always rule trade. Columbus might not have dared the short route to China if it were not for the silks that European women demanded of their husbands. So it is easy to understand why the British air machines carry such cargoes as they do. Milady's gown must be from Paris and it must be here at once! Use the air line!—*Editorial in N. Y. Sun.*

The News of the Week

24,400 Foot Parachute Drop

Rantoul, Ill.—A new world's record for parachute jumping was established March 23 when Lieutenant Arthur G. Hamilton, one of the Air Service's crack jumpers, leaped from the cockpit of a De Haviland aeroplane at 24,400 feet above sea level. The pilot landed safely after drifting eight miles. The previous record was 22,000 feet, made in Texas on Feb. 22.

Lieutenant Hamilton, one of the men who took part in a triple jump at Chanute Field, went to sleep on the long, slow climb to the position of his leap. Lieutenant Harry Weddington, head of the Air Service Mechanics' School, piloted his pet De Haviland, "Jeremiah Second."

"When the altimeter showed they had reached 24,400 feet Lieutenant Weddington turned in his cockpit and found his companion in a doze. He awakened the jumper.

"Good luck," Weddington shouted above the roar of the motor as the jumper slipped sleepily over the side.

Down shot Lieutenant Hamilton. He said after landing that he had just enough strength to pull the cord, releasing the chute. The rush of the fall was checked after a drop of 200 feet. There was little wind when he jumped and indications were he would alight in the centre of Chanute Field.

About 1,300 feet up he struck a strong air current which carried him beyond the field and eight miles north of Rantoul.

While Hamilton was floating down with the wind Weddington landed, got another ship, took off, and flew to the field where Hamilton landed, reaching there about the time the jumper's feet touched the ground.

The record for the jump is official. Lieutenants J. L. Stromme and H. A. Shevlin sealed the barograph, which registers the altitude, before the ship took off. They took charge of the instrument the minute the ship landed and verified the record.

According to Lieutenant Weddington, the 22,000-foot jump in Texas was not recorded by a barograph, but merely by the ordinary altimeter.

Business By Aeroplane

Mobile.—Flying to Mobile from DeFuniak Springs, Fla., in a three-passenger Curtiss aeroplane, Charles E. Logan, of Funiak Springs, and his pilot, Jack Moran, were unable to find Mobile in the smoky fog which prevailed Friday evening, and flew past the city a number of miles. Mr. Logan came to Mobile by aeroplane to interview members of the county board of road commissioners regarding the use of road building machines which he invented several years ago.

As Mr. Logan's business calls him to many parts of the south almost daily, he makes all his trips by aeroplane. The trip from DeFuniak Springs, a distance of 160 miles was made in an hour and thirty minutes.

Experiment On New Mine Laying Device Is Made

Washington.—A new method of planting mine fields, involving the use of aircraft and a special type mine, equipped with a parachute, has been the subject of recent experiments conducted by the navy in Chesapeake Bay, it was learned recently.

The mine used is the invention of Charles Lee, mechanical engineer of Portsmouth, Va. The mechanism consists of the mine, anchor, cable and silk parachute. Large number of aeroplanes, each carrying a number of the mines, can be sent over the area to be mined, and the devices dropped at regular intervals. The parachute eases the descent to the exact spot selected, and the instant the mine hits the water the parachute is detached and floats away to sink later.

Parachute Controlled By Radio Will Drop Bombs

Paris.—Louis Damblanc, a French engineer, has just taken out a patent for an ingenious device of interest regarding aerial bombardments. M. Damblanc has invented a planing apparatus which dropped overboard from either an aeroplane or airship could plane down to earth several miles away. Such a machine carrying a big load of bombs or ammunition could be of exceptional use in war time, the inventor claims, particularly in view of the fact that it can be regulated to drop at a given point, and furthermore, would reduce the dangers of aerial bombardment. The machine can also be controlled by wireless and several machines could be carried in any fair-sized aeroplane.

Aerial Frolic at Cushing, Okla.

St. Patrick's Day was celebrated in Cushing, Okla., by the holding of an aerial frolic under the auspices of the local post of the American Legion. The afternoon was given over to passenger carrying and a stunting exhibition. The Curtiss Southwest Airplane Co.. of Tulsa. sent five planes, and there were other privately owned planes from various places in attendance.

Work of the American Engineering Standards Committee

Although the American Engineering Standards Committee has been actively at work for only slightly more than one year, and much of the time and effort of the committee has necessarily been spent in laying a basis for work the fruition of which will require at least two or three years, yet considerable progress has already been made in the unification of the more important standards and in overcoming the confusion that was being produced by the numerous organizations (more than 100) that hitherto published engineering standards without systematic co-operation among themselves.

Following is the section of a report, that will be issued shortly, concerning aircraft standards:

Aircraft Standards. Acting upon a request from the Secretary of the International Aircraft Standards Commission, that arrangements be made, if possible, for American participation in the next meeting of the Commission, the American Engineering Standards Committee invited the various government and industrial organizations interested in aircraft standardization, to send representatives to a conference, to discuss the question. The conference, which was held in Washington on August 11th, was attended by representatives of the Departments of War, Navy, Post Office, Commerce, and Agriculture, the National Advisory Committee for Aeronautics, the Society of Automotive Engineers, Manufacturers Aircraft Association, American Society of Mechanical Engineers, and the American Society for Testing Materials.

It was the unanimous view of the conference that there should be American participation. A committee was appointed to present the matter to the President

The giant Caproni tandem triplane flying boat "Sesta Calende". It is equipped with eight 400 H.P. Liberty motors, has a span of 100 feet, length of 74 feet, and carries a useful load of 25,000 pounds

through the Chairman of the Council of National Defense. As a result, the President addressed a letter to the National Advisory Committee for Aeronautics requesting it to arrange for the presence of American representatives at the conference. The National Advisory Committee for Aeronautics has taken steps toward the organization of a delegation. The meeting of the International Commission itself has, however, been postponed, to allow time for agreement to be worked out between the various national committees which compose the Commission, on the precise scope of the work to be undertaken, and the relation of the Commission to the Air Navigation Convention. The International Aircraft Standards Commission has a quasi-governmental status. The Air Navigation Convention was formulated by the Peace Conference at Paris.

To Print A Newspaper While Flying In Clouds

The latest thing in the field of journalism is the *Aerial Mail,* a daily newspaper, which is edited, printed and published from an aeroplane in flight. The *Daily Mail,* which is sponsoring it, says it will contain the latest British and Continental news, political, financial and general, received both at the moment the aeroplane "takes off" and while it is flying, the news being sent by wireless. A special printing plant has been installed and newspapers will be distributed by means of parachutes dropping the editions into the towns the aeroplane flies over. There probably will be editions for Boulogne, Rouen and Amiens, as well as for Paris and London.

Aeroplanes will leave Paris and London daily, the one leaving Paris to print the *Aerial Mail* in English and the one from London to print it in French. The newspaper will contain market quotations, racing results and more or less general news from all principal capitas. It will have four pages and will contain advertising as well as "feature" articles.

Men back of the project say that the public is so dependent on newspapers that there is a field for such a service as they propose, but that if the present newspaper service is to be improved it can be achieved only by the use of the aeroplane.

Scientists Discover German Dirigible Secret

Scientists in a Pittsburgh steel mill have discovered a formula, long sought by British and American naval authorities, which the Germans used in the construction of frameworks of Zeppelin dirigibles, it was announced at the Philadelphia Navy Yard March 25.

It also was said the discovery and its practical application would make possible the speeding up of work upon the giant dirigible under construction at the Philadelphia Navy Yard for the greater part of a year.

Hitherto nothing has been known of the composition of the aluminum alloy used in the framework of Zeppelins save that it was lighter than steel and of great tensile strength.

It was determined that the strength of the metal lay in its treatment by heat, and scores of attempts were made to determine the proper temperature. The scientists, however, have discovered something else, essentially American, which will go into the new alloy.

Sailing Vessels Last Hope For Lost Balloonists

Pensacola, Fla.—Search for the naval balloon, with its five passengers, which has been missing from the air station here since last Tuesday, was largely suspended because of low hanging clouds and threatening rain which forced the dirigible C-7 to remain in its hangar and seriously curtailed the maneuvering by the fleet of seaplanes.

The C-7 will make a thorough search of Bay and Holmes counties, where it is thought possible the balloon might have landed, but no chance that might lead to a rescue is being passed by. The belief is that if the men are still living they are on board a sailing vessel not equipped with wireless.

Officials feel almost certain of two things: First, that the balloon would not have sunk, and, second, that if it had been afloat on the surface of the Gulf within a 300-mile radius it would have been sighted.

Assistant War Secretary Makes Flight To New York

Richard Wainwright, Assistant Secretary of War, got a vivid impression of what rapid transportation in the air service means when he flew from Washington to Mineola, L. I., in one hour and twenty-five minutes in a De Haviland plane, piloted by Capt. William Ocker. The start was made at 2:35 from Bolling Field, near Washington, and at 4 o'clock the wheels of the big Liberty-motored plane touched Mitchel Field. The time is said to be several minutes under the previous record.

After reaching the field Secretary Wainwright made an inspection with Major A. J. Christie, commander of the field. He complimented the officer on the condition of field and equipment and said he believed the field should be enlarged in view of its relative nearness to the city and its increasing importance.

Residence of Mrs. John S. Phipps, of Westbury, Long Island, photographed by Captain James Suydam

The AIRCRAFT TRADE REVIEW

Huge Caproni Wrecked By Gale

According to newspaper despatches the huge Caproni triplane, with capacity for 100 passengers, was badly damaged in a recent gale which came down suddenly while surface tests were being made. The extent of the damage is not yet known, but it is stated that most of the aerofoils will require to be rebuilt.

Giant Seaplane For U. S. Navy Will Carry 75 Men

Rapid progress is being made at the League Navy shops on the new flying boat B GB-1, which is to be the largest hydroaeroplane in the world and which is intended for trans-pacific flight. The great craft will be powered with no less than nine Liberty motors geared up to three propellers. These motors will develop a total of 3,600 horsepower.

With a wing spread of 150 feet and a hull 65 feet long, the B GB-1 has been designed to carry 75 passengers, a larger number than ever carried by any heavier than-air machine.

The time of the trial of the gigantic ship will to a large extent depend upon the incoming Secretary of the Navy. Work may be rushed so as to make the flight across the Pacific by next September or October, but in the normal course of events the ship will not be prepared for flight until some time in 1922.

Wood Aerial Transportation Co. Plans

Pensacola.—Appearing before the chamber of commerce recently, E. W. Stone, agent for the Wood Aerial Transportation Company, presented plans which his company expects to put into actual operation. The proposal includes the inauguration of an air line from Pensacola to Mobile, from Mobile to New Orleans, and from Atlanta to Mobile, Pensacola and New Orleans. In the future the company may extend operations to Havana.

Mr. Stone's company will use flying boats for its coastwise transportation and believes it can handle passengers at a 100 per cent. increase over rail rates. This would offer an incentive, Mr. Stone believes, for aerial transportation, because of the decreased time. The matter was referred to the board of directors.

Ship Plane Designs

Navy Department experts are now examining competitive designs recently submitted exclnsively by American designers for ship planes. There are two features of the specifications upon which bids were asked which are of especial interest: those concerning takeoff and alighting requirements.

As to the first, the machine must be planned to take off in not more than 150 feet when the ship from which it hops is steaming at a rate producing a wind speed of twenty knots relative to the deck; the plane must also be sufficiently stanch to stand the strain of being catapulted, kicked off, at an acceleration of 64.4 feet a second, and begin to climb immediately after being catapulted. Regarding landing on the deck laymen have heard something of arresting devices such as intercepting wires weighted with sand bags, but it is of interest to learn that the plane pilot, in spite of these aids, must be furnished with a machine under the Navy requirements which can slow down to a speed not exceeding forty knots before coming into contact with the deck of the mother ship.

The machine the Navy is asking for is to carry two men and must be fitted with wireless apparatus. It is intended not for scouting, as seems to be generally believed, but for gunfire control.

Aerial Mapping of Mississippi Swamp Lands

Request has been made to the Chief of Air Service by Assistant Sanitary Engineer, W. H. W. Komp, of the United States Public Health Service, Jackson, Mississippi, for a detail of aeroplanes, pilots and observers to make an aerial photographic map of the area immediately adjacent to and including the towns of Rosedale, Cleveland, and Merigold, Miss., a section comprising about 15 square miles. The terrain is described as almost absolutely flat, broken by shallow, sluggish bayous, the banks of which are heavily timbered. The flat nature of the territory and the prevailing method of farming is described as being ideal for photographic mapping, and the large fields under cultivation would provide adequate landing fields.

In response to this request the following letter has been sent: "In reply to your letter dated March 1, 1921, regarding aerial photographs of areas immediately adjacent to and including the corporations of Rosedale, Cleveland and Merigold, Mississippi, the Chief of Air Service directs me to inform you that your request has been favorably considered, and desires that you submit to this office the location of the nearest recognized landing field in the vicinity of the area to be photographed.

"The Air Service is very desirous of cooperating with your Bureau in demonstrating the value of aerial photography in this particular kind of work, and therefore it is planned to give this project priority. The possibility of completing this work by June 1st is not certain, but if no unforeseen conditions arise it will probably be finished by the last of July."

Lt. Moseley Makes A Flight In "Messenger"

Lieutenant Corliss C. Moseley, defender of the Pulitzer trophy, gives the following interesting account of a recent flight from Washington City to Langley Field in the little "Messenger", one of the smallest aeroplanes in the world, which was designed by the Engineering Division of the Air Service, to take the place of the motor cycle in performing certain messenger service. The "Messenger" which was manufactured by the Lawrence Sperry Company of New York City, stands 7ft. high, is 17 ft. 9 in. in length, with wing span of 20 ft. and is capable of carrying a total weight of 240 pounds including the pilot, and of flying at a speed of 90 miles an hour.

Of his flight in this miniature plane, so entirely different from the Verville-Packard in which he won the Pulitzer race, Lt. Moseley writes: "To attend the opening of the new Officers' Club at Langley Field, I flew down from Washington in the 3-cylinder, 60 h.p., air-cooled Lawrence motored "Messenger", traveling at an altitude of, approximately, 600 ft. The little plane carries ten gallons of gasoline only, and not knowing the fuel consumption, I took along a 5-gallon can of gasoline in the rear seat."

"When about half way to Langley, I landed in a field and poured the extra gasoline into the tank. Some negro laborers were very much interested in the machine, and in my sudden appearance from the sky, but it took me more than a half hour to persuade them that the plane would neither kick nor fly away with them. After many questions and much laughter on their part, I finally induced some of them to hold the wings and tail of the machine while the motor was started. After that preliminary, it was only a matter of a few moments before a take-off was accomplished, as the propeller turns much more easily than a Ford is cranked."

Aerial Forest Patrol

Ninety de Haviland-4B's will be utilized by the Ninth and 91st Aero Squadrons in forest patrol operations in California and Oregon during the coming summer months according to word received from Rockwell Field, San Diego. Forty of these planes have already been shipped to Mather Field, San Diego. The remaining 50 are now being overhauled and assembled and will be ready for shipment before the first of April.

It is understood that five service squadrons will operate from Mather Field this summer. Authority has been requested to organize two more squadrons to supplement the work of the Ninth and 91st. Officers and men for these operations, it is believed, will be obtained from various flying fields and bases on the Pacific coast.

Mather Field, Rockwell Field, March Field, Red Bluff and Fresno will be the principal operating bases for forest patrol squadrons. At least six planes will be in operation from this base and a more wide area of mountain forest will doubtless be covered than in past seasons. Whether the landing field at Santa Barbara will be maintained this summer has not as yet been decided.

Captain Clark, officer in charge of flying, will doubtless be in charge of the patrol again and will announce personnel of the squadron at a later date. The forestry department is expected to again assign a man to this base for duty with the patrol. Wireless communication will again be utilized between ships en-flight and the base of operations.

Night Flying Soon

Night flying will be started at March Field next week according to Captain Clark, officer in charge of flying. Three planes have been equipped with proper lights and the large search lights for flooding the landing field with light are again in commission. Lieutenants Clark and Colliver have been named as instructors.

SOME EXPERIMENTS ON THICK WINGS WITH FLAPS

By C. D. HANSCOM*

Chief Engineer of the Glenn L. Martin Company

THE subject of thick wings has been taking on a constantly increasing importance in aeronautical discussions for several years. Since the war, with the urgent necessity for instant production removed, aeronautical engineers have been turning to practical experiments. It should, therefore, aid in general aeronautic development if all information on the subject is made available for common use. The Glenn L. Martin Company has recently had tests made in the wind tunnel of the Massachusetts Institute of Technology in the endeavor to obtain more data on the action of wings with flaps. Both front and rear flaps were employed, and the results showed several interesting features. When it was decided to have the experiments made, no sections were at hand which possessed all of the qualifications needed. It was especially desirable that the movement of the flaps should produce minimum discontinuities of surface. This requirement at once limited the choice of sections. Ultimately four base sections were adopted and the new wings developed from them.

Four Master Sections

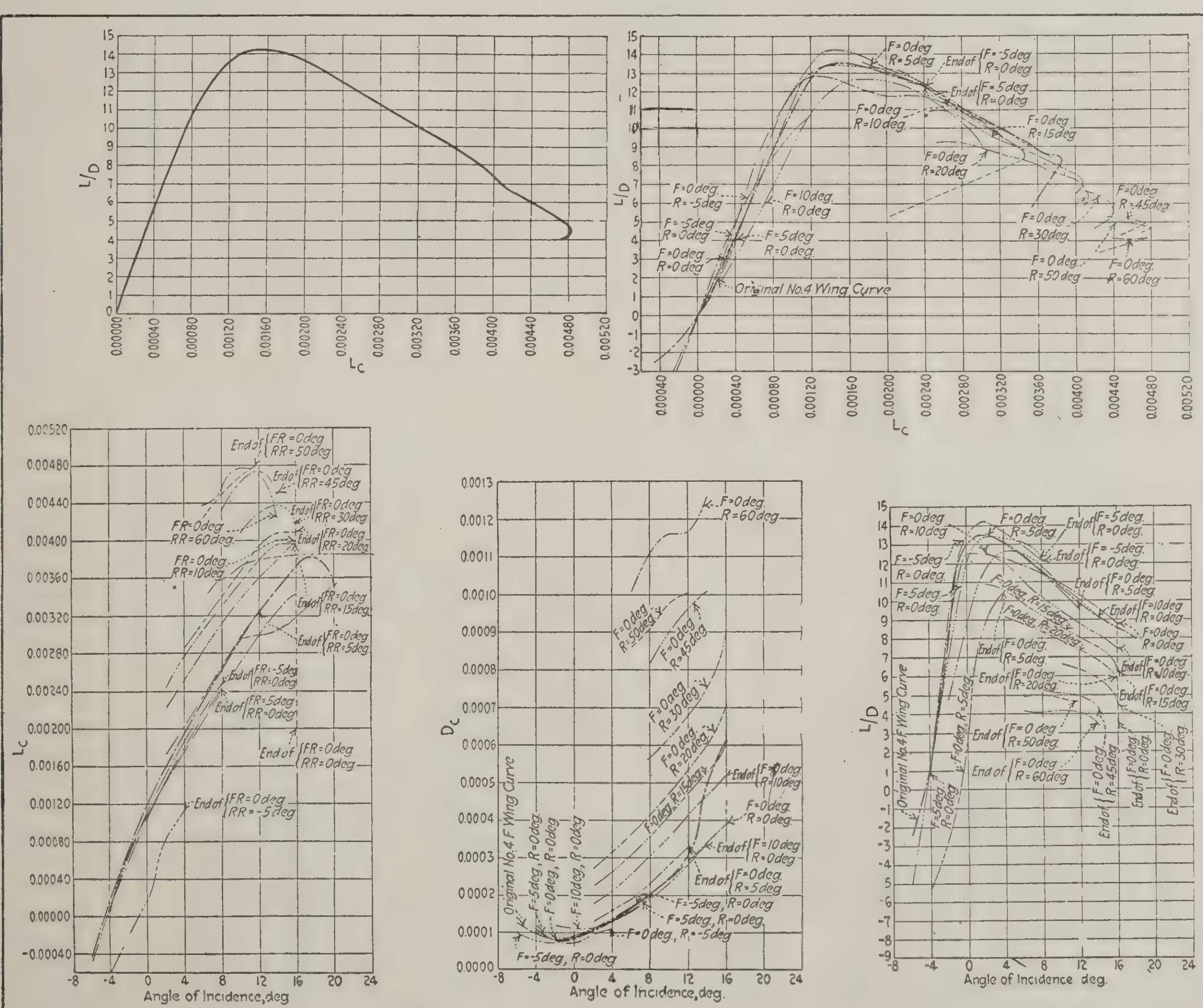
The first, and most logical, choice was the USA 27. The wing developed from this section eventually proved the best of those tried. The second base section was a wing of my own, the H1, the data for which has never heretofore been published. A third base section, which is now being shown for the first time by permission of its designer, G. M. Denkinger, was the D1. The fourth master section was a composite curve which resembled no wing in particular.

From these master curves, six new wings were designed. The USA 27 was thickened appreciably, and minor modifications were made in its form. The new section was called the No. 2. The D1 was uniformly increased in camber, by a percentage ratio, producing the Glenn Martin No. 5. The H1 was modified in three ways. The rear upper surface was raised in all cases to allow more room for the flap. This injured the qualities of the wing to a considerable degree. One wing, designated as No. 1, was then made having a sharp trailing edge; another, No. 6, with a blunt trailing edge, and a third, No. 4, with a blunt trailing edge and a practically flat under camber. The fourth master section was modified only slightly, having been designed especially for the purpose. This latter was called No. 3.

The six models and the sockets were made at the Massachusetts Institute of Technology by its employees. The ordinates given in the different illustrations were scaled from sections of these models, and therefore represent to a good degree of accuracy the actual sections tested. The models were all 3 x 18 in., and the wind velocity was always 30 m.p.h. The tests themselves were under the personal direction of Prof. E. P. Warner. I was also present, and at the balance in most cases.

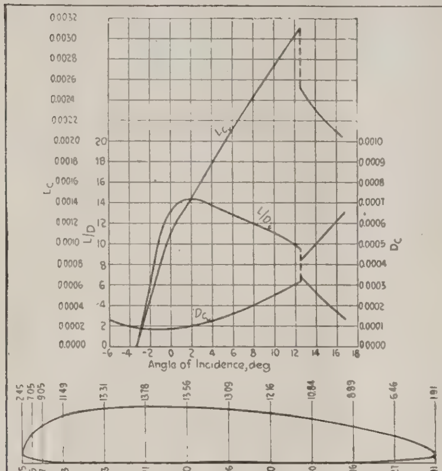
The special qualities which led to the selection of the four master sections deserve attention. The USA 27 was not thick enough, nor did it have a sufficiently high lift for the purpose for which it was needed. It was, however, by far the best section known. It was therefore only logical that it should be chosen. The form of the Glenn Martin No. 3 was arbitrarily adopted, the purpose being to combine low drag at small angles with good lift at higher angles. The *L/D* was

* Paper read before S.A.E.

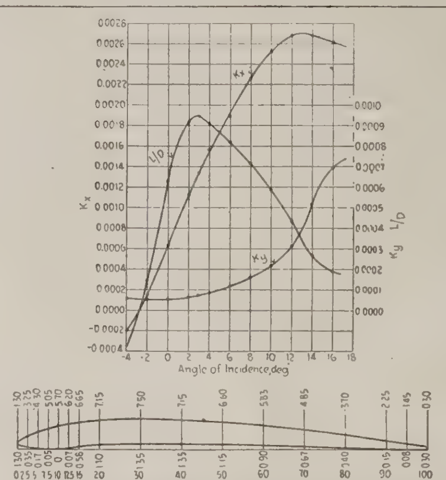


COMBINED CHARACTERISTIC CURVES OF THE GLENN MARTIN 4F WING SECTION

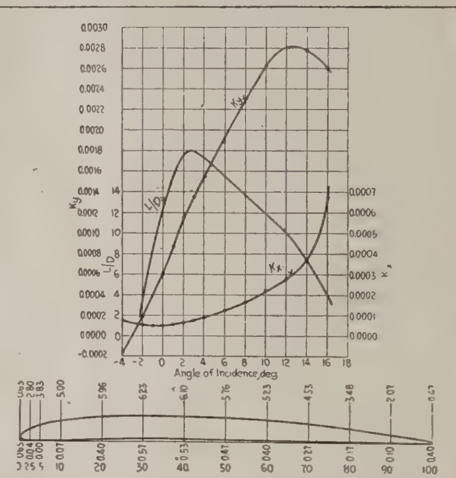
better than for any of the other sections, but the lift proved unsatisfactory. The choice of the D1 and H1 wings was the result of private tests made in 1919. The D1 was designed as a high-speed section. It actually proved to be one of the best known wings, of practical shape, at a lift coefficient of from 40 to 50 per cent of the maximum. In this range, and in fact everywhere above it, the D1 is much superior to the RAF 15. Below 36 per cent, at high speeds, it is inferior, although not greatly so. No change was made in the section in stepping all ordinates up by the same ratio to obtain the Glenn Martin No. 5. The H1 was designed to attain good efficiency at large angles and, if possible, a high lift. The high lift did not materialize, but the L/D at climbing speeds varying from 66.6 to 75 per cent of the maximum L_c is excep-



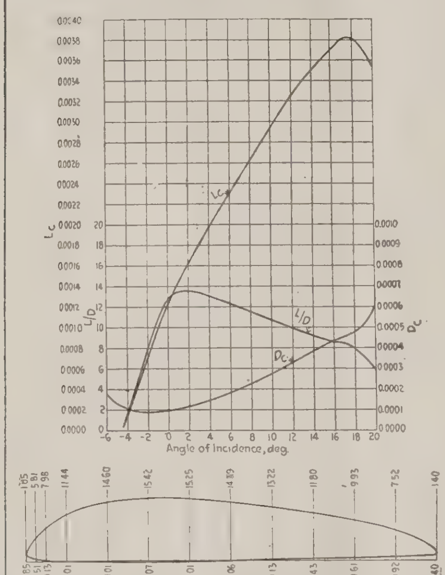
Dc, Lc AND *L/D* CHARACTERISTIC CURVES AND SECTION ORDINATES FOR THE GLENN MARTIN 3 WING SECTION



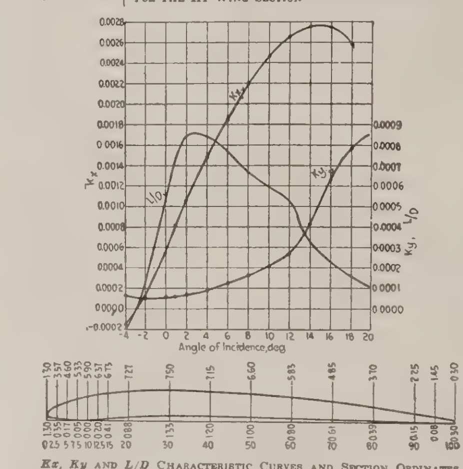
Kx, Ky AND *L/D* CHARACTERISTIC CURVES AND SECTION ORDINATES FOR THE H1 WING SECTION



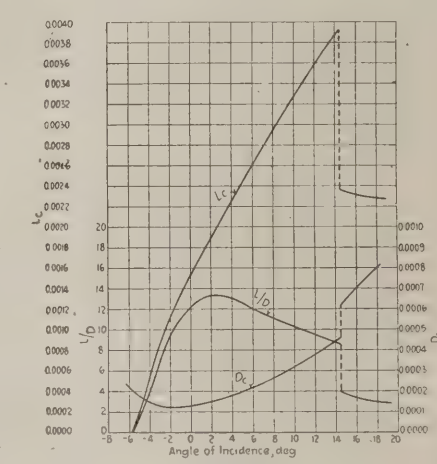
Kx, Ky AND *L/D* CHARACTERISTIC CURVES AND SECTION ORDINATES FOR THE D1 WING SECTION



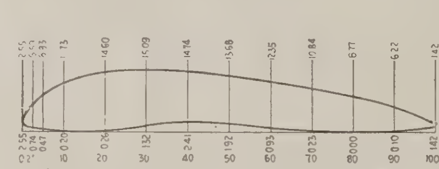
Dc, Lc AND *L/D* CHARACTERISTIC CURVES AND SECTION ORDINATES FOR THE GLENN MARTIN 4 WING SECTION



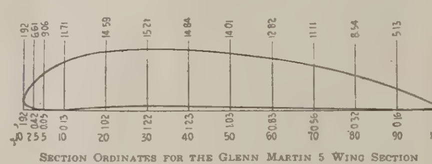
Kx, Ky AND *L/D* CHARACTERISTIC CURVES AND SECTION ORDINATES FOR THE H3a WING SECTION



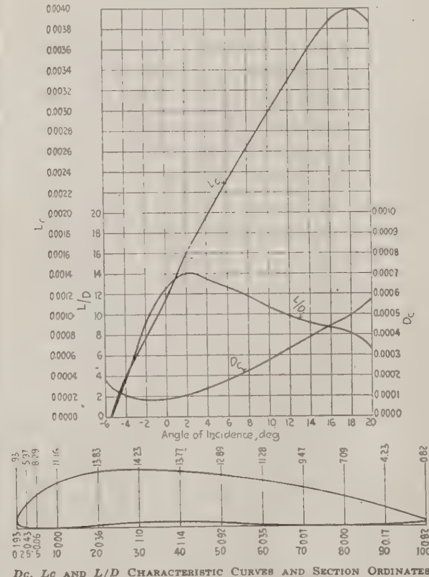
Dc, Lc AND *L/D* CHARACTERISTIC CURVES FOR THE GLENN MARTIN 5 WING SECTION



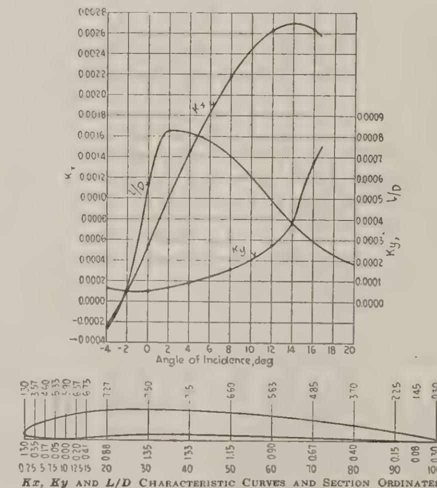
SECTION ORDINATES FOR THE GLENN MARTIN 6 WING SECTION



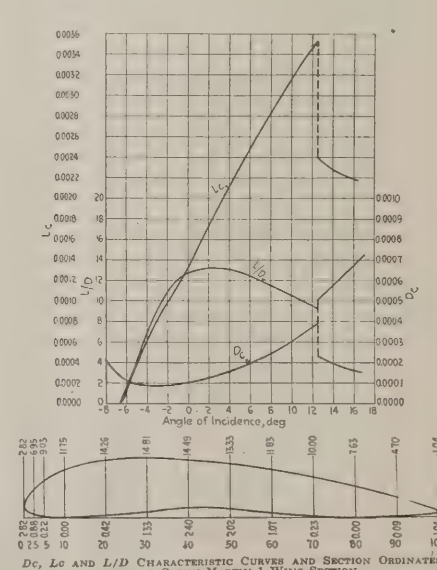
SECTION ORDINATES FOR THE GLENN MARTIN 5 WING SECTION



Dc, Lc AND *L/D* CHARACTERISTIC CURVES AND SECTION ORDINATES FOR THE GLENN MARTIN 2 WING SECTION

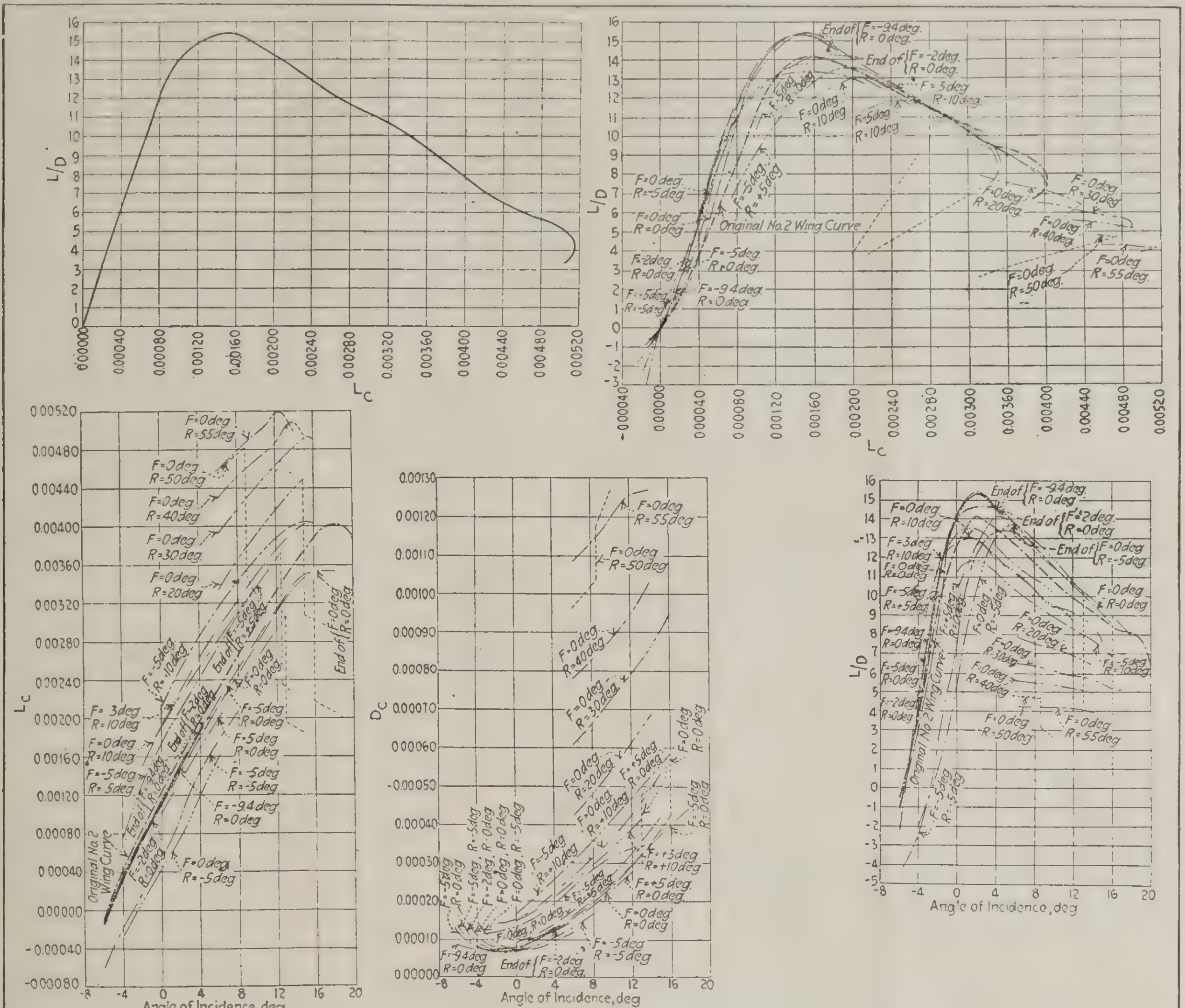


Kx, Ky AND *L/D* CHARACTERISTIC CURVES AND SECTION ORDINATES FOR THE H3b WING SECTION

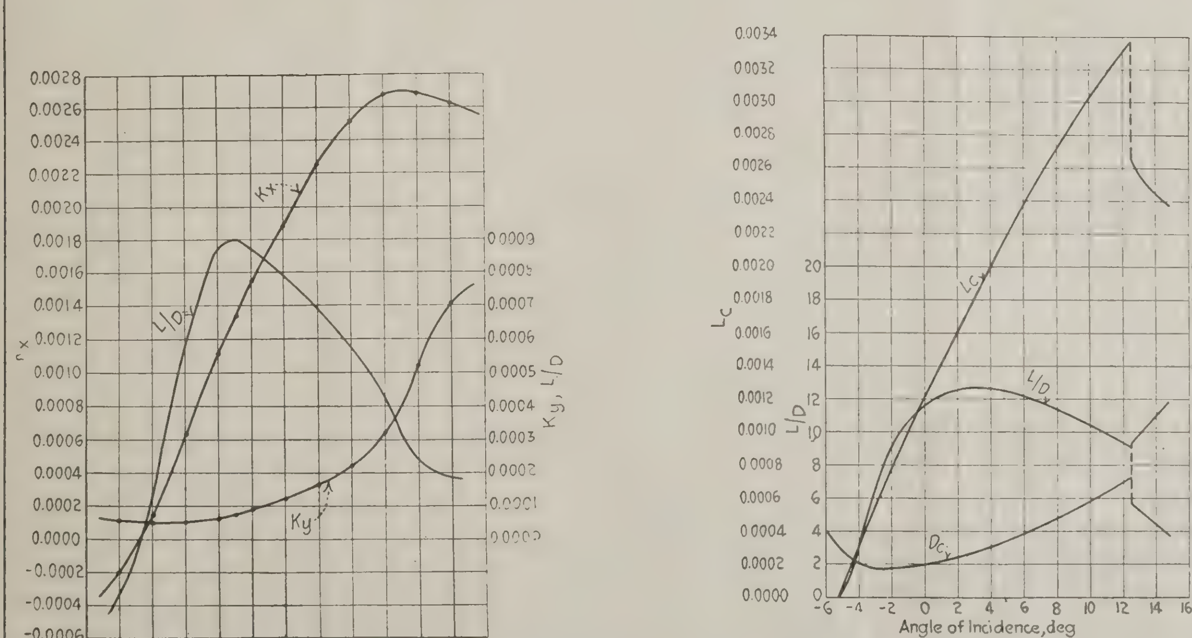


Dc, Lc AND *L/D* CHARACTERISTIC CURVES AND SECTION ORDINATES FOR THE GLENN MARTIN 1 WING SECTION

tionally good, being 16 to 15.[1] Two attempts were made to improve the lifting qualities of this section, by thickening the nose, but they failed to accomplish their object. The wings thus produced, H3a and H3b, are practically the same except that H3a has a very slight bump on the lower surface at 50 per cent of the chord. The difference in the characteristic



COMBINED CHARACTERISTIC CURVES OF THE GLENN MARTIN 2F WING SECTION



Dc, Lc AND *L/D* CHARACTERISTIC CURVES FOR THE GLENN MARTIN 6 WING SECTION

curves is, therefore, noteworthy. H3a and H3b, however, merely indicated the advisability of making the modifications in H1 as small as possible.

Unfortunately, H1 had to be changed to a considerable degree to permit flaps to be employed. The rear lower surface had to be bulged down to accommodate the hinges and operating mechanism, and to relieve the sharpness of the break which would occur when the rear flap was pulled down. These changes proved one point in the original design. Efficiency at high angles was obtained in the H1 by making the angles of trail, approximate angles made by the upper and lower rear surfaces to the chord, as nearly the same as possible. In other words, the trailing part was thin. The new Glenn Martin wings based on the H1 apparently lacked any exceptional efficiency at large angles because of the thickening of the trailing part out of proportion to the rest.

New Wing Designs

The six new wings are sufficiently described by the characteristic curves and tables of data. It may be noted that discontinuities occur in several cases at the burble point. This phenomenon is not unusual for thick wings, and, of course, disappears at higher velocities. It is obvious that the Glenn Martin No. 2 and the Glenn Martin No. 4 are the best of the six. The Glenn Martin No. 5 would undoubtedly have shown a higher lift in proportion as the velocity increased, but its lower efficiency ruled it out.

Sections Nos. 2 and 4 were therefore tested being hinged at 15 and 70 per cent of the chord length. The hinges were approximately 0.03 in. from the bottom surface, and the hinge-plates were sunk flush with the surface. The slight hollows at the hinge-plates and the cracks between the flaps and the main part of the wing were filled with plasticine. The sections were retested, and the errors of alignment noted. It is, of course, impossible to cut a wing in this manner and duplicate the original results, unless the model is metal. The errors, as indicated by a study of the model and the curves obtained, seemed due chiefly to lack of perfect alignment of the flaps. After a standard position for the flaps had been determined, the other tests were run at accurate angles with respect to this standard; but the standard varied slightly from the original wing. Since the envelope curve is the ultimate goal, this minor error, while annoying, is relatively unimportant.

The Glenn Martin No. 4F, which was the No. 4 section with flaps added, was run first. The test demonstrated clearly that at very low angles of lift coefficient a negative angle is best for both front and rear flaps; but that at any speed ordinarily reached, the front flap only should be raised from the normal position. At high values of lift the front flap could profitably be in its normal position, and the rear flap should be down about 45 to 50 deg. It is only at the burble point and beyond that there is any noteworthy gain from the lowering of the rear flap.

The Glenn Martin No. 2F gave better results than the No. 4F, as expected. The conclusions drawn in regard to the use of flaps are almost identical. An angle of —5 deg. for the front flap is beneficial at all values of lift up to the burble point of the original wing. At very small lifts, the front flap can be raised even to —10 deg. with additional gain. In this latter region, also, the rear flap should be lifted to —5 deg. As the burble point is reached, the front flap apparently should come to 0 deg., and from there on the rear flap should be brought down by successive stages to about + 55 deg.

The qualities of the wings with flaps, as indicated by these tests, remain to be considered. The maximum lift increased 25 per cent for the No. 4F and 29 per cent for the No. 2F, over the original wing. These new maxima,[2] 0.00484 and 0.00516, constitute the highest lift coefficients yet attained at far as I am aware.[3] The drag at this extreme lift is, however, very high. It is interesting to note that for the No. 2F the L/D is 15.1 at 25 per cent of L_c maxima, and 8.4 at 11 per cent.[4] These values of L_c correspond to speeds of twice and three times the minimum respectively. It would therefore appear that for racing machines the use of a wing with flaps is highly desirable. For heavy weight-carrying planes, the drag would be high at low speeds; and the performance would resemble that of the Fokker-Junkers, which seems to be slow in pulling up from the ground, but climbs well when a good flying speed is attained.

The effect of an increase in speed and scale is uncertain, since experiments on thick wings with flaps have not been made. There is, however, no reason to believe that the wing charactristics would not improve to an appreciable extent. In any event, full-flight tests can soon settle the question.

---

[1] Two sets of characteristic curves are shown for the H1. Those having the maximum L/D of 17.9 are the standard Massachusetts Institute of Technology tests. The others, with a maximum L/D of 18.9, show the same data corrected for spindle interference to permit of a direct comparison with the tests performed at the National Physical Laboratory, Teddington, England.

[2] If a correction is appplied for the reduction of chord and area with the flaps at large angles, L_c would approach 0.00575 in the case of the No. 2F.

[3] The largest value I have noted elsewhere is that recorded for the RAF 19 in Report and Memorandum No. 648, published by the Advisory Committee for Aeronautics (Great Britain). That report records $C_l = 0.93$, or $L_c = 0.00474$. The Handley Page apparently only reached $C_l = 0.8$, or $L_c = 0.00408$.

[4] The corresponding values for the RAF 15 obtained from National Physical Laboratory tests are 14.5 and 7.7 per cent.

(*Continued from page* 84)

gine speeds. These, by increasing safety, should greatly lower insurance rates and increase traffic. He thought it was more important to lower cost by improving safety than by lowering pressure. The present speed of 120 m.p.h. seemed adequate to deal with adverse winds, but the landing speeds of 50 or 60 m.p.h. were too high when one took into consideration the very high dihedral angle of the present-day machines. Another effect on design that might be expected was that there was going to be more weight available for the engine and its gear and accessories, and the propeller. The difference, when one took away 2 or 3 lb. from the 15 lb. that was available for load, in order to obtain greater safety and quicker get-away, was going to be well worth while. It might interest Mr. Handley Page to know that in his (Col. Ogilvie's) own machine, which he got out of the Wright machine, he got 33 lb. per h.p. In present-day machines putting in two or three pounds for gearing and variable pitch should be well worth while. His old machine got off at about 38 m.p.h., and had a maximum speed of 50. Still, one got off safely with 33 lb. per h.p. One should get a lift coefficient of 2 with a loading of 20 lb. per sq. ft. and an aligning speed of 45 m.p.h. If the Handley Page wing was any better than the R.A.F./19, one could get 90 m.p.h. with 42 lb. per h.p., of which there could be at least 22 lb. of useful load to go with four hours' fuel. Improvement in regard to the shock-absorbing properties of under-carriages should give increased safety. The difficulties of the design, though, would be pretty serious. Varying wings to an angle of about 40° and individually moving connections might seem simple to Mr. Handley Page, and perhaps they would be when they had seen them in shape.

Prof. L. Bairstow said that in the main points he agreed with the last speaker, and also with the lecturer in his summing up of the adventages of the high-lift wing and the reduction of landing speeds which could be secured. It was not quite so easy to get full advantage of the high-lift wing in the improvement of top speed if one kept the landing speed higher; but Mr. Handley Page's figure of 15 as the possible lift/drag ratio was a great improvement on the present-day 9. The center of pressure problem in the variable-cambered wing—or the new Handley Page wing—was not the same as in a fixed wing. Balance in machines depended on the position of the center of pressure on the main spans, and also on the down-wash, which was affected by the opening or closing of the slot; and the angle of the down-wash was, roughly, proportioned to the lift ratio. If an aeroplane were flying just above the stalling speed with the slot closed, and then the slot were opened, there was an increase of lift coefficient, cutting out the burble, and correspondingly increasing down-wash, which depressed the tail. What one would like was that the center of pressure should have a tendency to go back to the correct point. It was possible to change the wing in the middle—the part which sent the down-wash over the tail—so as to get exact correction between the center of pressure changes and the lift coefficient changes from the closing of the slot, but that point would need a considerable amount of working out. With regard to lateral control, Mr. Handley Page had shown that flaps would operate behind a wing which had a slot, but the curves also showed that such a wing was more liable to spin than a wing of normal character. On the other hand, it did not spin until it was stalled, and the stalling angle occurred much later. But if a wing of that decsription did stall, the rate of rotation in the spin would be much greater. The problem of preventing that spin was accentuated with high-lift wing.

Col. Bristow said that Mr. Handley Page made a casual remark to the effect that he put a single unit in front of the main plane to reduce the expense of the experiments. It was lamentable that experiments of such a vitally important character should have to be carried out in a manner that would save a few pounds in a country that spent 1,000 millions a year. It was astounding that there could not be some arrangement by which the money could be found by the Government. If the Government Aeronautical Department were there they would, no doubt, feel that money should be found for experiments of this character.

THE HANDLEY PAGE WING

By F. HANDLEY PAGE

(Continued from page 38)

The results are plotted in Figs. 17, 18 and 19. With six slots the lift coefficient reaches the abnormal value of 1·96 at an angle of 45°, and in comparison the curve of R.A.F./15, which is also plotted on Fig. 17, looks almost microscopic. At the angle of inclination of 45° at which this large value of lift coefficient is obtained, the tangent of the trailing edge of the aerofoil is practically vertical, showing that the air is being deflected through the maximum angle possible and is leaving the plane practically in a vertical direction. Fig. 18 shows the lift/drag plotted against lift coefficient, and Fig. 19 the horse-power per lb. weight against speed.

These tests indicate that with a multiple-slot arrangement an increase in lift coefficient can be obtained of two to three times the normal value without the slot.

The tests so far described have all been monoplane tests, carried out in the wind tunnel at a speed of 40 ft. per second. A further series of tests was carried out on several sections—of which aerofoil 42 is an example—to determine whether the same effect could be obtained on a biplane. The results in Fig. 20 indicate that an increase in the lift coefficient of approximately 40 per cent. was obtained with a single slot, and that a normal result was obtained. Further tests carried out since have clearly shown that with the necessary biplane corrections the slotted monoplane tests can be applied to biplane calculations.

Centre of Pressure Tests

Aerofoil No. 32, the lift/drag coefficients for which have already been plotted in Figs. 9 and 10, was tested for its centre of pressure movement, and the results are plotted in Fig. 23. At any given angle the centre of pressure with the slot open is slightly farther back, but taking into account the decrease in lift coefficient at small angles with the slot open, for any given value of the lift coefficient the difference is not great. The general result, however, of the centre of pressure line being slightly behind that of the normal position is one that might be anticipated as the pressure is more evenly distributed over the whole plane, and therefore the aft portion has a greater lift. This causes the result of the centre of pressure to lie farther back.

In commenting on the tests carried out on this section the National Physical Laboratory reported as follows:

"The high lift obtainable with the flap open is very remarkable, especially in view of the fact that the position of the centre of pressure is little altered. At the critical angle the C.P. is at 0·295 chord with flap open, which corresponds with its position at about 8° incidence with flap closed. The longitudinal balance of the machine would be approximately the same when flying at 8° incidence or landing at 22° incidence, a very valuable characteristic. Scale effect in lift and drag are both considerable, but little effect on C.P. is found."

Flap Experiments With Slotted Aerofoil

An increase in the lift coefficient can be obtained by the use of a plane with flaps and altering the angle of incidence of these flaps. A series of tests was carried out at the National Physical Laboratory, published in the report for the year 1913-14, pp. 111 to 128. The results have been plotted in Fig. 24, compared with aerofoil No. 32 with the slot open and the slit closed. The R.A.F./19 curve shown is the envelope of the various curves, as plotted in Fig. 32 of the report referred to above. The maximum lift coefficient on aerofoil No. 32 is approximately .943, as against .82 with the flap, which at this value was set back at an angle of 60°. The increase in lift coefficient by the use of flaps can be obtained with the slotted plane as with the ordinary one. A series of tests was carried out on the section shown in Fig. 25, and the results are plotted in Fig. 26. With the plane inclined at 18° and 19°, a progressive increase in the lift coefficient is obtained, but at 20° and 21° the plane is inclined at the critical burbling angle, and owing to this results are somewhat unstable. Further experiments have determined that the rolling moments obtained with the alteration of the flap angle are of the same order as those on the plane of ordinary cross-section, indicating that full control can be obtained by ailerons in the ordinary manner when the slots are open.

Reference has already been made to pressure distribution plotting on a slotted plane. These experiments were carried out on aerofoil No. 42, this being a R.A.F./15 section with an extra nosepiece added (Fig. 27). The results are shown in Fig. 28. The shape of these curves is very similar to that of the ordinary pressure plotting, except for the break in the curves where the slot is opened and the higher values in pressure obtained at the leading edge of the aft plane.

General Conclusions

The record which has been given is one of progress in experimental work with the slotted plane. In general, the results show that depending upon the slot shape, position, width, inclination, etc., an increase in lift coefficient of from 40 to 60 per cent. can be obtained with one slot, and up to 200 to 300 per cent. with a multiplicity of slots. The drag coefficient is slightly increased on the slotted plane with the slot closed, compared with an unslotted plane of similar cross section. The gap on the lower surface of the plane makes but little difference to the drag, but any discontinuity on the upper surface is at once attended by a large increase in the drag coefficient. With flaps fitted to such an aerofoil the necessary increases in lift coefficient can be obtained, so that a proper aileron control is still available. This is a distinct advantage over the method of increasing the lift coefficient by alteration of the flap angle, for with the flap at its maximum angle no aileron control is possible. The center of pressure is slightly aft of the position at smaller angles on a plane of similar section, but unslotted. This result is evident from an examination of the pressure slottings which show that distribution of pressure on each of the smaller constituent aerofoils, whilst similar to an ordinary aerofoil, result in the lift being more evenly distributed over the plane.

Causes of "Burbling"

If reference is made once more to Fig. 28, it will be seen that as the angle of incidence is increased, the pressure at the leading edge increases very rapidly. At 14° the negative suction on the upper surfaces of the plane reaches a value of 1.2 for both auxiliary and main aerofoils. After this point is reached, the auxiliary aerofoil's pressure increases more rapidly, reaching 1.65 at 16° and 2.2 at 18°. At 18° the abnormal pressure increase over the small area at the front edge of the auxiliary aerofoil is followed by a very rapid pressure drop, the pressure on the main aerofoil only reaching a value of 1.3. This very steep pressure graduation immediately results in "burbling," the maximum value of the pressure at 20° having fallen to 1.75. The same type of results is found with an ordinary plane, except that the rapid rise in pressure of the leading edge would have taken place at a smaller angle. To prevent "burbling" it is therefore necessary to insure that the angle of the auxiliary planes is always kept sufficiently small, so that a rapid increase in pressure is avoided. With a multiplicity of slots this is possible, as has already been shown in the case of the R.A.F./19 tests. It would appear that the rapid rise in pressure is due to abnormal velocity increase, with corresponding contraction of the live air stream, and that slightly farther back on the plane the necessary velocity reduction cannot be effected without setting up discontinuity and the eddying effect nnown as "burbling."

Effect on Design

The increase in lift coefficient possible with the slotted aerofoil permits either of slower running speeds than at present, or alternatively, of less power at top speed. The first is self-evident; the second requires some explanation. In an aerofoil design with unslotted planes, the lift coefficient at top speed is usually less than that at which the best value of lift drag is obtained. The landing speed and maximum lift coefficient determine the value of the lift coefficient at full speed, the drag at this latter speed—excluding body resistance for the moment—the horse-power required to obtain this speed. With the slotted plane the reverse procedure may be adopted. The lift coefficient top speed can be chosen with reference to the best lift/drag ratio of the plane, and the slow speed for alighting obtained by the provision of the necessary number of slots to give the required lift coefficient. At top speed it will therefore now be possible to work at lift coefficients between .2 and .3 instead of the lower values which call for the use of a section such as R.A.F./15 with low values of drag at very small angles. The trend of design would therefore be towards the choice of sections with high lift/drag ratio rather than fairly high lift/drag ratios at low values of the lift coefficient. If, then, machines can be designed with their planes at normal cruising speed, set at angles of incidence where the lift/drag ratio is not less than 16 and perhaps as high as 21 or 22, a great economy will be effected in the horse-power that is required. Economy does not, however, rest with the planes alone, for if the planes are more efficient it will pay to sacrifice a little weight to diminish the body resistances of the aeroplane. It would appear from our recent experiments that a total lift/drag ratio on a complete aeroplane can be obtained of not less than 1 to 15 at the top speed. With this value and the propeller efficiency of 70 per cent., a speed of 120 miles per hour can be obtained with 33 lb. per horse-power. It is evident that results such as these will emphasize the importance of improved methods of propulsion at slow speeds, so that the problem of arising with such heavy

loads per horse-power is made easier than it would be at the present time.

The experimental results which have been given above have been confirmed by full-size tests on a DH-9, the front edge of which was altered so that its section included a slot in front of the front spar. The increase in lift coefficient measured from the decrease in stalling speed showed that the full-scale results followed closely the laboratory experiments.

Mechanical Devices Necessary

The operation of the auxiliary plane or planes to effect the transformation from slot closed to slot open does not present very great difficulties, nor does their addition to the structure lead to very much increase in weight. One of the simplest methods is by the simple swivelling of the front auxiliary portion, but in this device and in the actual methods of control many solutions are possible, and experience in manufacture and operation can only indicate which is the best. It is to be hoped that the results which have been given above and the investigation which has been conducted will lead to further experiments being carried on elsewhere, so that improved results may be obtained to the benefit of aircraft and aviation generally.

The Discussion

Col. A. Ogilvie said there could be little doubt that if one accepted the general conclusions Mr. Handley Page had given, a very great advance had been made. The simplest thing was to compare the 33 lb. per h.p. which Mr. Handley Page said he could get with a machine of the present day which would do the same speed. A present-day machine to do the same thing was unable to carry more than 12 lb. to 15 lb. per h.p. The structure of the machine was not a much greater percentage. The fuel should be the same, and the engine should be the same number of lb. per h.p. The real difference one got in the two sets of equations was in the load. The difference there in the two cases was a comparison of 15 or 17 lb. to 4 or 5 lb. In other words, three times the load could be carried. That alone showed a tremendous gain if this invention was able to be applied successfully. The fuel costs were high—probably about one-third of the cost of running the service. One of the most important advantages was the lower en-

(*Continued on page* 82)

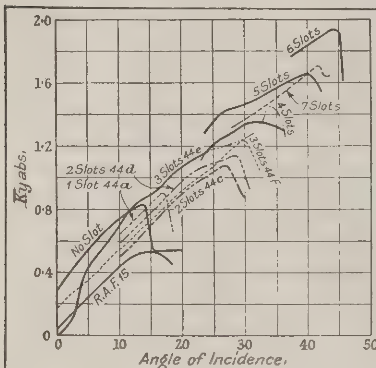


FIG 17

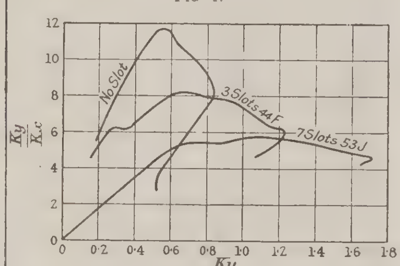
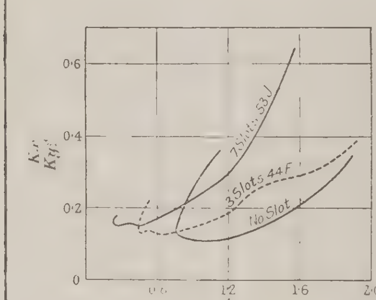


FIG. 18



F 19

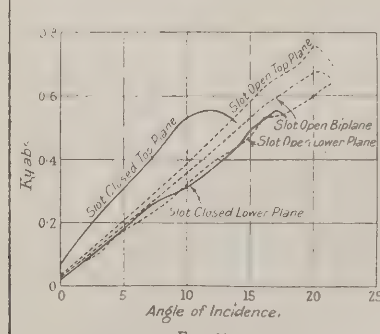


FIG. 20

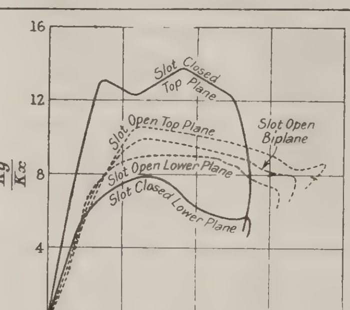


FIG. 21 *Ky abs.*

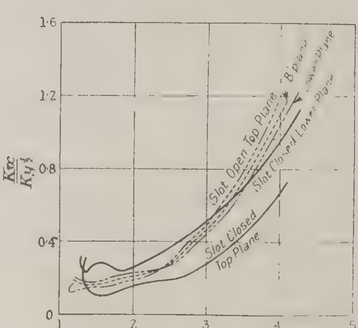


FIG. 22

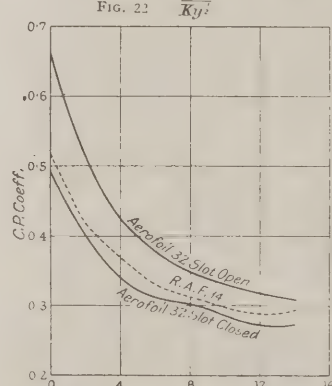


FIG 23

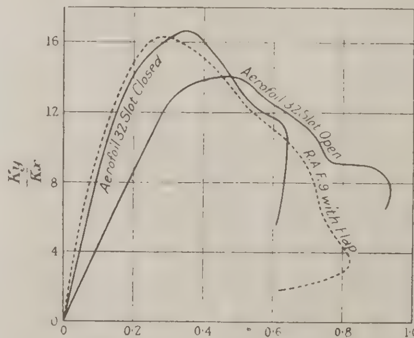


FIG. 24 — *Ky*

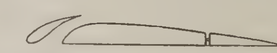


FIG 25—Slotted Aerofoil with Flap

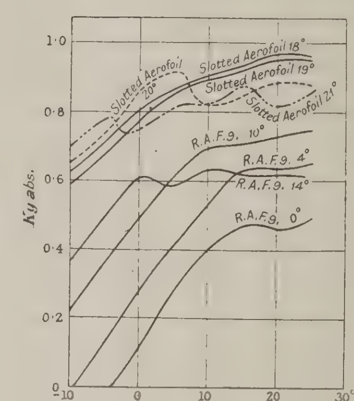


FIG. 26 *Angle of Flap.*

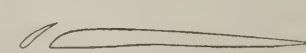


FIG. 27
Slotted Aerofoil No. 42

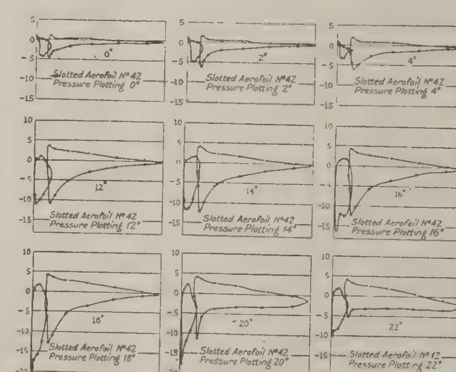
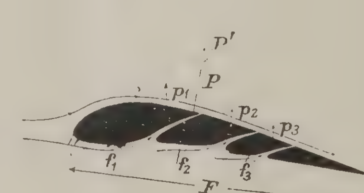


FIG 28



The Lachman Section

WHO'S WHO IN AERONAUTICS

Jesse Gurney Vincent

Lieutenant-Colonel Jesse Gurney Vincent, Vice-President of engineering of the Packard Motor Car Company of Detroit, Mich., one of the designers of the Liberty Motor and prominently identified with the aircraft production industry, was born at Charleston, Ark., February 10, 1880, a son of Joseph Merill and Nellie Gurney Vincent. The elder Vincent is still engaged in farming. The family is of sturdy American stock and has been identified with the various professions and the development of the country for many generations, Mr. Vincent's grandfather practicing medicine in Illinois and Iowa for many years, and his maternal grandfather, N. A. Gurney, a civil engineer, spending his life in railroad work, and among other things, surveyed and assisted in building the B. & O. S. W. Railroad, including the shops at Pana, Ill.

Jesse Gurney Vincent was brought up on a farm until 17 years of age, during which time, he attended the country school near Pana, Ill., later, in St. Louis, graduated from the Cote Brillinte Grammar School.

At an early age, having a natural inclination for mechanics, he entered a machine shop, attending school at night and taking up a correspondence course in engineering, which fitted him for the important work he was destined to contribute towards the industrial development of the world. When 17 years old, he left his father's farm and entered the employ of Smith Vincent & Company, Commission Merchants, at St. Louis, where he became a bookkeeper and acquired a general knowledge of business. He later became a machinist's helper, in a machine shop, then a machinist and afterwards a tool maker. This work being congenial, he labored with enthusiasm, and in 1902, the Universal Adding Machine Company of St. Louis, offered him a position as tool maker, and in a few months he was given charge of the department, which afforded him the opportunity to pursue original investigation in mechanics. Shortly afterwards, in the fall of 1903, the Burroughs Adding Machine Company of St. Louis enlisted the services of Mr. Vincent, who, owing to the removal of the plant to Detroit, Mich., went there, first as a tool designer, and soon afterward was promoted to superintendent of inventions, in which position he rapidly organized a large inventions department, where most of the improvements on the Burroughs Adding Machine either were conceived or made practical. This machine is one of the most complicated and yet one of the most simple of mechanical devices, the simplicity being entirely in the operation, for it is composed of several thousand parts and performs an apparently miraculous achievement by the mere twirl of a lever. In the latter part of 1910, Mr. Vincent retired from the staff of the Burroughs Company, leaving a highly efficient inventions department made up of more than 100 trained men, and joined the staff of the Hudson Motor Car Company as chief engineer, remaining in that

capacity for a period of two years, which were marked by the improvement of the Hudson automobile. In the fall of 1912, he accepted the position of chief engineer with the Packard Motor Car Company, and about a year later was promoted to the office of Vice-President, in charge of all their engineering activities, which position he retained until August 10, 1917.

During this period, he became well-known as one of the leading engineers in the automobile industry, and in the year 1914, he designed the now famous Packard Twin Six, which, after exhaustive research work, was brought out by the Packard Motor Car Company in the fall of 1915. The excellent results obtained from this Twin Six design led Mr. Vincent to make an exhaustive study of this type of engine for aeroplane use during the years of 1915, 1916 and the early part of 1917, being spurred on to do this research work at a considerable cost through the firm conviction that America would eventually enter the war and that high-powered aircraft engines would be badly needed, the result being that when America did finally enter the war, Mr. Vincent was in a position to lend valuable assistance to the Government, not only on account of his personal knowledge of modern aircraft engines, but on account of the fact that he had built up a highly trained engineering organization, which was available to carry out important development work.

Mr. Vincent went to Washington the latter part of May, 1917, having arranged for a conference with members of the Aircraft Production Board, for the purpose of developing a standardized line of aircraft engines, resulting in the production of the famous Liberty Motor, and at the request of the Government officials, the Packard Motor Car Company loaned Mr. Vincent's services to the Government, to supervise the engineering work on this engine. This arrangement continued until August 10, 1917, when Mr. Vincent resigned his position with the Packard Motor Car Company to accept a commission in the Army, as Major in the Signal Corps, September 3, 1917, remaining in Washington until the early part of October, in charge of the Engine Design Section of the Equipment Division, and then went to Dayton, Ohio, where he organized the Airplane Engineering Department of the Equipment Division. This department was charged with the passing on designs of aircraft engines, also on aeroplanes and aeroplane equipment. On February 7, 1918, Major Vincent was promoted to Lieutenant-Colonel, and on July 26, 1918, he received his R.M.A., having, in the meantime, mastered the art of flying and passed his examination.

When the reorganization took place and the Bureau of Aircraft Production was created, Lieutenant-Colonel Vincent remained in charge of the Airplane Engineering Department, which became known as the Airplane Engineering Division of the Bureau of Aircraft Production, and a complete engineering organization and laboratories were built up at McCook Field, Dayton, Ohio.

At the time the armistice was signed, this organization had become very efficient and had the aeroplane engineering work under good control. Shortly afterwards, Lieutenant-Colonel Vincent applied for his release and received his honorable discharge on November 30, 1918, remaining in Dayton for another month to put his successor in touch with all the details of the Division. He returned to Detroit on January 1, 1919, to again take up his duties with the Packard Motor Car Company, as Vice-President, in charge of engineering.

FOREIGN TECHNICAL DIGEST

The Vickers-Saunders "Valentia"

The "Valentia" flying boat, now completed at the Cowes works of Messrs. S. E. Saunders, Ltd., is partly of Vickers and partly of Saunders design. That is to say, the superstructure, wings, etc., were designed by the designing staff of Messrs. Vickers, Ltd., while the boat hull was designed by Saunders. This applies not only to the lines of the hull but also to the constructional design. As is to be expected, "Consuta" sewn ply-wood is used throughout the hull, even to the wing roots, and this material, which has already proved so successful in the Vickers "Viking" amphibian machines, looks extraordinarily well on the "Valentia." For the benefit of those who are not acquainted with the "Consuta" method of construction it may be mentioned that, briefly speaking, this consists of cementing together several thicknesses of wood, with the grains of one layer at angles to the other as in ordinary ply-wood. The resultant sheet of ply-wood is then sewn on a special machine, the seams running parallel to one another and at an angle with the grain of the wood. Thus one does not have to rely upon the glue only to hold the layers together, but has the extra strength of the stitching as well. Exhaustive tests have shown that the "Consuta" construction is extraordinarily strong for its weight, and there is little doubt that it will be employed to a very great extent in the future. Its uses are practically limitless, not only for the covering of bottom, sides and deck of flying boat hulls, but also for *monocoque fuselage* construction, as for instance in the Vickers Vimy-Commercial. It has also been used for wing covering in the Saunders "Kittiwake," where it was designed to take part of the wing stresses. Numerous other uses could be suggested, but sufficient has been said to indicate the scope for this material.

As regards the "Valentia," she is a twin-engined flying boat biplane, with the engines mounted in a pair of vees between the planes and driving tractor airscrews. The span of the upper plane, which has a considerable overhang, is 112 ft., and the overall length is about 58 ft., while the height is 22 ft. A model of this machine was, it may be remembered, exhibited on the Vickers stand at the last Olympia Aero Show. Sufficient petrol is carried for a flight of 8 hours' duration at a cruising speed of about 100 m.p.h., so that the range is about 800 miles.

The hull is of the vee bottom type, with flat "tumblehome" sides, not unlike that of the famous "Viking" in general lines, although differing somewhat from it in details. Two more machines of the same type are under construction, and the first of the three machines will probably have been completed and flown by the time these lines are in print. We understand that Capt. Cockerill, the famous Vickers pilot, who has been making alighting tests with the "Viking" on the Thames, will test the "Valentias." (Flight, March 10, 1921.)

The D.H. Cantilever Monoplanes

For some time now work has been progressing rapidly at the new Stag Lane works of the de Haviland Aircraft Co., on the two cantilever wing monoplanes ordered by the Air Ministry. Owing to the confidential nature of the work we have hitherto refrained from mentioning anything about these machines, but as the daily press has started talking it may be as well to put on record briefly what the new machines will be, although detailed references would not at present be advisable. The machines, which will be fitted with one 450 h.p. Napier "Lion" each, have their *fuselage* of three-ply construction, with a pronounced "tumble home" to the sides so as to get a wide base for the attachment of the undercarriage struts. There will be a very large cabin which can be used for a variety of purposes, such as wireless experiments, photography, etc. If designed for commercial use, the cabin would, of course, accommodate the passengers.

The wings, as already mentioned, will be of the cantilever type, and it is worthy of note that in wind channel tests of a scale model it was found that results were obtained which were better than those of the ordinary wings with their bracing. Naturally it is not permissible to give figures, but there seems to be ample proof that the cantilever wing is not nearly as black, aerodynamically, as it has been painted. At present the construction of the wings is being thoroughly tested out, and some very good results have been obtained, quite high factors having been attained with the form of spar construction which will be used. Again details are not permissible.

It may be remembered that in the paper read before the Air Conference last year, Mr. H. White Smith gave in tabular form the cost of running various types of machines, among which the D.H. 18 came out most economical. With the new machines it is hoped to attain even better efficiency, although being of an entirely new type this is more or less of an estimate. The machines are frankly experimental, but are certainly very promising.

(*Flight,* March 10, 1921.)

The Bristol "Tramp"

Among the few firms which are still busy on aircraft construction is the Bristol Company who, in addition to a large Air Ministry order for Bristol Fighters, are engaged on the construction of a new triplane, somewhat on the lines of the luxurious Bristol "Pullman," except that it is not designed to carry passengers. The *fuselage* is very roomy, so as to provide ample space for cargo. The power is to be furnished by four Siddeley "Puma" engines of 230 h.p. each, and the carrying capacity of the machine will be in the neighborhood of 2½ tons. The speed will not, of course, be as high as that of the Pullman, the power being much smaller. The Air Ministry are said to contemplate various uses for this machine, such as carrying spare parts from one air station to another. If desired, the machine could also be used for wireless experiments, photography, etc. (Flight, March 3, 1921.)

A Vickers Red Cross Machine

At the Weybridge works of Messrs. Vickers, Ltd., a new machine is now nearing completion which is designed for Red Cross work. The machine is more or less on standard Vimy lines, but in place of the usual seats the cabin is fitted up to take four stretchers, and there is also room for a doctor, nurse, and orderly. Thus urgent cases can be transported great distances in a very short time and with a maximum of comfort. (Flight, March 3, 1921.)

Winter Flying—Engines

The difficulty of keeping aero-engines warm in wintertime is dealt with in this article by Lt. Col. Douglas Joy, of Camp Borden. "The best solution of the problem," he says, "is the use of portable engine heaters placed close to the engines and oil tanks, and the whole covered with padded covers. In many types of aeroplanes it is also desirable to build a bulkhead at the rear of engines or oil tanks, in order to avoid loss of heated air.

"The heaters in ordinary use are of three kinds—electrical, slow combustion and catalytic.

"The electrical heater, when the aeroplane is to be used not far from its aerodrome, is by far the most preferable owing to its cleanliness, ease of operation and economy. These heaters are of two different kinds, those that heat the water in the cooling system directly, and those similar to an electric stove, that heat air.

"When using the water-heater type care should be taken that the water circulates in a direction reverse to normal, that is, the heated water should pass into the bottom of the radiator, otherwise the coolest part of the circulation system would be around the bottom of the radiator, in which small passages the water is apt to freeze, even though the main body of the engine is warm. Care should also be taken to see that the radiator is well covered, for the water tends to flow across the radiator in a small hot local current, leaving the more exposed portions to freeze and burst.

"Slow combustion heaters, of the foot-warmer type, are desirable for cross-country flying or when electricity is not available. They require a special fuel, however, which is not always easily obtainable, and a certain amount of care and attention.

"Catalytic heaters, generally used overseas, are really of the slow combustion type, using gasoline as fuel. They consist of a small pail divided into two parts, the lower part containing about one-half gallon gasoline and the upper part containing a substance similar to cotton or wool or asbestos placed around with a wire gauze—from the upper part a wick projects into the gasoline in the lower part. After filling the lower half with gasoline a little is spilt through the wire gauze on to the fibre in the upper half. This is lit with a match and the small quantity of gasoline is soon burnt off in flames and when it goes out the fibre begins to glow and remains hot for 15 or 18 hours, depending only on the quantity of gasoline that can be drawn up by the wick.

"They are quite safe, and can be placed under a leaky gasoline feed without danger of fire." (*Aviation News*, Feb., 1921.)

NAVAL and MILITARY AERONAUTICS

Seaplanes and Photographic Mappings

In connection with the War Department's photographic mapping of the Delta of the Mississippi River, problems arose, because of the peculiar character of the territory to be photographed, which could only be overcome by the use of seaplanes. Consequently, the Secretary of War requested the Navy Department to take strips of mapping photographs on each bank of the South and Southwest Passes of the Mississippi to cover the marshy areas on each bank to the limit of their extent up to two miles from the river. This work is necessary in connection with the engineering projects of the Army District Engineer, and is of tremendous importance in the river and harbor improvement schemes at the mouth of the Mississippi.

The mapping could not be performed by the Army Air Service, principally due to the lack of landing fields in the vicinity. The Army has no aviation facilities in the Delta; however, the Army is to supply the gasoline and oil for the mapping planes and subsistance for the crews.

Work on this project will start immediately. Seaplanes from the U. S. Naval Aid Station at Pensacola will conduct the mapping work, and, after finishing the photographic flights requested by the Army, will obtain additional pictures for the Coast and Geodetic Survey, in order to complete the maps which that bureau has under way of the Gulf Coast.

It is estimated that by mapping these inaccessible areas from the air, many thousands of dollars will be saved over the old method of triangular and surface mapping and survey.

This work also shows the co-operation existing between the Army and Naval Aviation, and also the close co-operation between Naval Aviation and Coast and Geodetic Survey, this Delta mapping being one of many projects of the same kind which the Navy has undertaken for both departments.

Efficiency of Non-Rigid Naval Airship

At the Naval Air Station, San Diego, Cal., there was recently given a demonstration of the extraordinary efficiency of the non-rigid type of airship when searching the surface of the water for small floating objects, together with the co-operation between aircraft and surface craft in such problems.

The non-rigid airship, B-18, participated in the search for a torpedo lost from a vessel during battle practice. After a vigilant search of the lower bay off San Diego for about two hours and a half, the nose of the torpedo was sighted, the body of the torpedo being submerged. A smoke bomb was dropped within a few feet of the torpedo, denoting its location to a searching party on board a torpedo boat destroyer. The searching boat immediately responded to the call and recovered the torpedo, thus saving several thousands of dollars for the Government.

The ability of airships to hover over definite locations adds to their value in search problems of this nature.

Report of Target Season of 27th Balloon Company

The recent target season for the coast defenses of Manila and Subic Bays, for which balloon observation was furnished, began November 22, 1920, and was completed December 22. During this time observation and regulation of artillery fire by the lighter than air units at this station were as follows:

6 Regulations of fire for 3" rapid fire batteries,
8 regulations of fire for 6" rapid fire batteries,
2 regulations of fire for 10" gun batteries,
1 regulation of fire for 14" gun battery,
1 observation of fire for 12" long range gun,
7 regulations of fire for 12" mortar batteries.

During this firing all shots were observed with the exception of the last three in the case of a six inch battery (rapid fire) when a cloud passed between the balloon and target, entirely obscuring it. In another case a ten inch battery was assigned balloon observation which could not be furnished, due to the low hanging clouds at an elevation of five hundred feet.

In all the firing, the targets were wire screen covered with canvas, about eight feet square, and towed by tugs. During the practice of the 12" long range gun seven shots were fired at a target approximately at a range of 25,000 yards. The battery commander sighted on a tug stationed 15,000 yards away. In this shoot the tug which towed the targets, and which was at least 30,000 yards away from the balloon could very easily be distinguished, and also all of the splashes of the shells of this gun were easily observed from the balloon, but could not be reported with reference to the target which was so small that it could not be distinguished. If in this case the target had been the tug of a very small gunboat, even at 30,000 yards range, the balloon observer would not have experienced the least trouble in regulating the fire of this long range gun.

On the final day of the regular artillery practice, two balloons were flown each observing for three inch, six inch, and 12 inch mortars. As each rapid fire battery was brought on its target, it was dropped and observation shifted to the mortar battery. An example of the rapidity of fire for the artillery problem on this day was that in the eight batteries taking part in the shoot all completed their work within twenty minutes after the first shot was fired.

Communication during the target season between the balloon and batteries was over a field line to the balloon chartroom switchboard, thence to the Post switchboard and telephone system. In spite of the fact that no specially trained men were used in this shoot, excellent results were obtained in reporting data in time for the battery commander to make use of it. An example of good telephone service was that during the firing of a 14" gun battery, located on an outpost about nine miles away, and firing at a range of 11,000 and 15,000 yards away, the result of the balloon observation was given to the battery commanders before their own land observers near the batteries reported.

Planes Leave Station to "Spot" Targets For Fleet

Temporary operating bases will be established at Long Beach and San Pedro within the next few days for seaplane and ship-plane units of the Pacific Air Force, preparatory to "spotting" operations in conjunction with the spring target practice of the Pacific fleet. Work has been in progress for several days on the operation, and it is planned to have the personnel operating and caring for the 'planes sleep in tents. The machines will also be stored in tents.

A squadron of 12 De Havilands left North Island under command of Lt. Commander M. A. Mitscher for the new base and the tender Aroostook and 12 F-5-L seaplanes will leave the Air Station for the bases. Captain Mustin will be in command of the squadron.

It is thought that the 'spotting" work will keep these 'planes busy for two months. The planes will fly about 30 or 40 miles off shore.

Changes of Station of Officers

Report is made of the following permanent changes of station of officers for week ending March 8, 1921:

On March 5, 1921, Major John H. Pirie, C. A. C., detailed to Air Service, relieved from duty at Ft. Monroe, Virginia, and ordered to Carlstrom Field, Arcadia, Fla., to report not later than March 28, for pilot training.

Second Lieut. Bernard T. Castor, A. S., ordered from Carlstrom Field, Arcadia, Florida., to Chanute Field, Rantoul, Illinois, for course of instruction at Air Service Mechanics School. March 5, 1921.

Order previously issued sending First Lieut. Joseph E. Hall from Aberdeen Proving Ground, Aberdeen, Md., to Carlstrom Field, Arcadia, Florida, for pilot training, revoked March 5, 1921.

March 3, 1921—Major Harold Geiger, A. S., ordered from Ross Field, Arcadia, California, to Washington, D. C., for temporary duty in the office of the Director of Military Intelligence, thence to proceed to The Hague, Netherlands, for duty with the Military Attache, American Legation.

March 7, 1921—Capt. Roscoe A. Fawcett, A. S., ordered from March Field, Riverside, California to Rockwell Air Intermediate Depot, Coronado, California.

March 5, 1921—Following Medical Corps Officers ordered from stations indicated to Mitchel Field, Long Island, N. Y., for course of instruction at the Medical Research Laboratory:

Major Herbert C. Neblett, Carlstrom Field, Fla.
Capt. Robert K. Simpson, Camp Dix, New Jersey.
Capt. William M. White, Brooks Field, Texas.
First Lieut. Fabian L. Pratt, Walter Reed General Hospital, Washington, D. C.

FOREIGN NEWS

Handley Page Service Discntinued

"That Civil and Service aviation are closely allied and that the nation which is the strongest in commercial air traffic will be the strongest also in the aerial warfare of the future" is the publicly expressed opinion of the Controller-General of Civil Aviation. Nevertheless British civil aviation will cease to exist, unless the British Government decides upon a radical modification of the proposed subsidy of £60,000, the terms of which are utterly hopeless in comparison with the French subsidy, to which was due the closing down of the Handley Page London-Paris air service on March 1st.

It is not generally known in this country that, subject to the French aviation companies reducing their rates to proportions which, in the view of the French Air Ministry, will popularize their air routes for passengers and freight, payment will be made to the French companies at the rate of 8f per kilometre actually flown by single engine machines, and 12f per kilometre for twin-engine æroplanes. Further, in order to ensure machines of the most modern construction, 50 per cent. of the money required by civil aviation companies for new machines will be provided by the Government. On the other hand, the French officials insist upon a subsidized company maintaining a minimum number of aeroplanes in flying trim.

Some idea of the French official view of popular fares may be gathered from the following reductions which have already been insisted upon: Paris to Strasburg, reduced from 500f to 150f; Paris to Prague, return reduced from 2,400f to 1,000f. With the present rate of exchange, it is now possible for a passenger from London to reach Strasburg, via Paris, for less than the fare previously charged by the Handley Page Air Service for a ticket from London to Paris. The French Air Ministry is also taking an active interest in popularizing aviation by throwing open all aerodromes every Sunday to ex-military aviators who have returned to civilian life, and placing at their disposal, free of cost, machines borrowed from the aviation companies, as well as free petrol for joy rides and training. The Government will even insure the civilian aviators at the rate of 50,000f a head during their flights, and in the event of accidents to machines the Government will pay the damage.

The new French fares came into existence on March 1st, and as a result of a debate on the Air Estimates, which took place on the same date Mr. Churchill announced his intention of immediately setting up a committee, to include members of the aircraft industry, and aerial transport firms to devise methods for meeting the "changed conditions," and to make proposals for immediate action.

It now remains to be seen whether the outcome of the deliberations of the new committee will result in the payment of a subsidy of one hundred per cent. on the French rate of six guineas per head without which it is impossible for any British firm to compete successfully. Meanwhile the Handley Page Transport Company is the last of the British Aviation Companies to run a regular Continental air service, and the nation's civil aerodromes are to be maintained for the present at all events for the benefit of French, Belgium and Dutch Aviation Companies.

Civil Aviation in Australia

A Board of Civil Aviation has been created by the Commonwealth Government to control and regulate aircraft and encourage flying generally.

The Director of Aviation is at present preparing regulations, which in general principle will be on the lines of those now in force in England. When the regulations are promulgated, aircraft owners will be given three months to make arrangements for compliance. All aircraft must be registered and pilots licensed.

It is intended at an early date to appoint supervisors to examine pilots and decide the airworthiness of planes. A superintendent of aerodromes will make surveys of air routes in the Commonwealth and assist municipalities in the provision of emergency landing places. At present Australia is practically without properly established aerodromes, and for that reason the regulations now being drafted will differ from the laws in England regarding landing places.

Some notable achievements by private pilots have been recorded during the past few months. Mr. C. J. De Garis, publicity director of the Australian Dried Fruits Association, has traversed the entire eastern and southern fringe of the Continent in a D. H. 4 aeroplane which he has imported. His first important flight was from Melbourne to Perth via Adelaide and the route of the trans-Continental railway, a total distance of about 1,800 miles, which were covered in two days. The return trip to Sydney also occupied two days. Subsequent to the pioneer flight to Western Australia, the same airman flew from Melbourne to Brisbane, 1,100 miles, in two days and returned in one day. The latter feat is claimed to be a world's "record" in civil aviation.

There are now in Ausrtalia some 20 aviation companies, formed to engage in commercial flying. A Melbourne evening newspaper delivers its papers to outlying districts by air, and generally this form of rapid transit is being employed by business men. In the far northwest of Queensland, two ex-members of the Royal Air Force have established an air service linking up the Queensland rail terminal with the large cattle stations in the Northern Territory. A regular air passenger service between the mainland and Tasmania is being arranged.

Germany Awaiting Opportunity to Compete for Dominion of the Air

In the London "Times", considerable space is given to an article by its Berlin correspondent describing the preparation which Germany is making for entry into competition with other countries in aerial commerce, both by means of airships and aeroplanes.

By article 201 of the Treaty of Versailles, Germany was forbidden for six months after the coming into force of the Treaty to manufacture or import aircraft, parts of aircraft and engines, or parts of engines for aircraft. Owing, however, to Germany's failure to comply with those portions of the Treaty in regard to delivery of air material, the prohibition under article 201 has been prolonged for a period of three months following the completion of the delivery referred to.

The correspondent says in part:—

"When the air industry is set free, it is safe to predict that there will be a great outburst of energy here. There was, already, a certain amount of manufacture for export going on until the Air Commission confiscated the Junker planes at Hamburg, but it was as nothing to the plans in contemplation. These plans are likely to include two separate branches, the rigid airship and the aeroplane. Experts are already thinking out the special problems of each, and, in each case, the first question is that of utility. Long distance oversea flight can be left to the airship, while the shorter ancillary service should belong to the aeroplane.

"Passengers, post and parcels are to be the province of the aeroplane and that over comparatively short flights. A feature of passenger travel by aeropalne that will have to be considered, is the general inaccessibility of aerodromes. Flight is, at present, often in result a slower process than train travel because more time is lost in getting to one aerodrome and away from another than is occupied by the whole air journey.

"German aeronauts are giving this matter considerable attention. Here they have plenty of field for experience and the collection of actual data, since the passenger air service has already passed the stage of mere experiment.

"Recently, for instance, the Deutsche Redersi celebrated the fact that their machines had covered a total of 625,000 miles since beginning operations in February of last year. Their machines had carried 5,545 passengers in 6,208 flights besides 500 tons of cargo including about 33 tons of postal packages. Of the flights scheduled only 122 had had to be abandoned for weather or other causes, so that 98 per cent were completed. Only three accidents had occurred, and one of these was due to a passenger's jumping out before the machine had come to rest.

"When the war ended, Germany had some 40 aeroplane factories at work, turning out about 2,500 machines a week. After the defeat of Germany and the subsequent revolution, the majority of these firms switched over to other work. Three firms decided to manufacture machines for civil aviation. These were the Sablating company of Berlin, the Junkers' of Desau, and the Fokker factory of Schwerin, The Government is watching these developments closely, though present conditions do not allow it to take any open part in furthering the building of aeroplanes. The industry is encouraged to maintain its factories at a state of efficiency which will enable it to go ahead immediately when the time comes. The skilled labor is being kept employed.

"The 'Reichs' Air Department is at present in a state of semi-suspension, but its objects, openly stated, are to keep track of progress abroad and to prepare a program for the State subvention of the industry till it shall have established its position. The Department is also entrusted with the preparation of international air-traffic agreements with other countries."

Italian Machines for Spain

A Spanish aeronautical mission under Eng.-Capt. Josó Berahger, has been investigating matters in Rome under the guidance of Signor Ferrarin, instructor at the Madrid military aerodrome. So that his pupils may be thoroughly acquainted with Italian machines, he arranged this mission for the purpose of purchasing a number of war stock machines. Six A 300 Ansaldos, some Hanriots, and one M 9 flying-boat have thus been acquired. Although the mission tried to buy several Savoia flying-boats, they found none of these machines were for disposal.

In addition the Spanish Minister of War has been authorized to purchase from Italian companies aviation material intended for a Spanish military air service in Africa, totalling to 806,000 pesetas, approximately $166,500.

Czecho-Slovakia

Aviation in this Republic has taken a new step forward with the publication of an official journal, *Letectvi*, of which the first number has just reached us. It is the aim of this review to record the work that is being done in Czecho-Slovakia and, at the same time, keep their people fully informed of the world's aeronautical progress. In the editorial, attention is drawn to the fact that Prague, the caiptal of the Republic, is situated right in the center of Europe and that it is therefore destined to become an important terminal in future aerial transportation lines.

Belgian Congo Waterplane Service

In connection with the inaugural flight of waterplanes up the Congo, recently referred to in *Flight*, a correspondent of *The Times* writes that the difficulties confronting a newly established air service in a remote part of the world are now illustrated by the actual experience reported in connection with this pioneer airway. The service, which uses seaplanes, and follows the course of the River Congo between Kinshasa and Stanleyville, is operated by the Syndicat National pour l'Etude des Transports Aériens.

One of the main difficulties encountered has been in connection with possible forced landings through mechanical trouble. Sections of this airway are so isolated, and ordinary communications are so bad, that there is a risk of a machine which has alighted involuntarily never being heard of again; in any case, days may elapse, perhaps, before news comes through of what has happened.

To overcome this difficulty, temporarily, the expedient had been adopted of dividing a load between two seaplanes, which then set off together and keep each other company during their flight. In this way, should one have to alight through any mechanical trouble, the other either flies on, or returns, and reports accurately and promptly the position of the stranded machine.

A scheme is now being pushed ahead to establish wireless telephones along the Congo, and also in the aircraft, though the ground organization will not be an easy matter. For one thing, white labor is so scarce that intelligent negroes will have to be trained to "listen in" at, and to use, the wireless telephone instruments. Another difficulty, experienced in the afternoons, is that the tropical heat causes "atmospherics" which may interfere with the wireless.

Air Mail Service for Newfoundland

The Post Office authorities at St. Johns, Newfoundland, announce the inauguration at an early date of an aeroplane mail service in the north portion of the island.

Aero Club of Holland Interested in Aerial Touring

With a view to speeding up the development of civil aviation in Holland, the Royal Aero Club of Holland has appointed a committee for aerial touring. Among the items which are put down for its consideration are: Modifications of the International Aeronautical Convention to facilitate aerial touring; study of the best machines for touring; competitions; development of aerial routes; research work on signals, etc.; simplification of customs formalities; means for popularizing aerial touring.

ELEMENTARY AERONAUTICS *and* MODEL NOTES

CLUBS

PACIFIC N.W. MODEL AERO CLUB
921 Ravenna Boulevard, Seattle, Wash.

BAY RIDGE MODEL CLUB
8730 Ridge Boulevard, Bay Ridge, Brooklyn

INDIANA UNIV. AERO SCIENCE CLUB
Bloomington, Indiana

BROADWAY MODEL AERO CLUB
931 North Broadway, Baltimore, Md.

TRIANGLE MODEL AERO CLUB
Baltimore, Md.

PASADENA ELEM. AERONAUTICS CLUB
Pasadena High School, Pasadena, Cal.

NEBRASKA MODEL AERO CLUB
Lincoln, Nebraska

BUFFALO AERO SCIENCE CLUB
c/o C. Weyand, 48 Dodge St., Buffalo, N. Y.

ILLINOIS MODEL AERO CLUB
Room 130, Auditorium Hotel, Chicago, Ill.

SCOUT MODEL AERO CLUB
304 Chamber of Commerce Bldg., Indianapolis, Indiana

MILWAUKEE MODEL AERO CLUB
455 Murray Ave., Milwaukee, Wis.

CONCORD MODEL AERO CLUB
c/o Edward P. Warner, Concord, Mass.

MODEL AERO CLUB OF OXFORD
Oxford, Pa.

CAPITOL MODEL AERO CLUB
1726 M St., N. W., Washington, D. C.

AERO SCIENCE CLUB OF AMERICA
Beach Bldg., E. 23rd St., New York City

AERO CLUB OF LANE TECH. H. S.
Sedgwick & Division Sts., Chicago, Ill.

LITTLE ROCK MODEL AERO CLUB
1813 W. 7th St., Little Rock, Ark.

The Correction of Propeller Torque

CORRECTION for the torque of a propeller when power is on can be made automatically by arranging the wings in an unsymmetrical position so as to give one wing more lift than the other. This can be accomplished by drooping the end of one wing and raising the end of the other wing. Another way is to give one of the wings a "wash-out" (that is, a progressive decrease in incidence from the body to the wing tip) and a "wash-in" on the other wing (a progressive increase of incidence from the body to the wing tip). A lack of symmetry, however, will give a tendency for the machine to spiral when the power is off. In an aeroplane under control of a pilot, this may be corrected by the use of the controls, but in diving it may spin and may become uncontrollable, and for that reason, such lack of symmetry is not desirable. A machine made unsymmetrical as a corrective measure for propeller torque is easiest to fly in normal flight with the power on, while a symmetrical machine is the better when gliding. It remains with the designer to choose between the two conditions.

Wings With Variable Camber

A highly cambered wing section is the most desirable for climbing and for landing, while a wing with less camber is more suitable for high speed. Having made this discovery, engineers have been led to experiment with means for causing the form of a wing to be alterable during flight so as to obtain, with a single wing structure, the advantages to be derived from the deep camber for maximum lift and the flat camber for speed.

A method often proposed is to hinge the rear portion of the wing and to vary the angle between the two portions by suitable mechanism. This principle was actually tried out on a large aeroplane but the results of the experiment were far from favorable, for the speed range was not great enough to enable full advantage to be made of the possible gain.

Of the many model tests made on this idea, one of the most complete and satisfactory was made on a staggered biplane of which the top section was an R. A. F. 13 wing curve and the bottom an R. A. F. 11. The hinge was located .37 of the chord. Comparing at each lift coefficient the setting of the flaps which gave the best lift-drag with the value found for the flaps straight, it was determined that little improvement occurred at a lift coefficient of less than .3. After this, there was a slight improvement, but the principal gain was in the increased maximum lift obtainable by increasing the camber. The maximum lift coefficient was increased from .49 to .61. It is possible that some such increase would actually obtain on the full size aeroplane, but it is doubtful whether it is worth the extra weight and complication.

Models Built by Aerial Age Readers

R. G. Galbraith of Pittsburgh, in addition to completing a model of the Verville Packard from plans published in the December 20, 1920, issue of AERIAL AGE, has incorporated some novel ideas of his own which show how individual ideas may be developed by thoughtful builders. One idea consists of a spring device which stops the propeller in a horizontal position when the rubber is unwound. This makes it possible for the machine in landing to strike the ground with little risk of breaking the propeller. In ordinary landing with the propeller rotating naturally or held vertical, the propeller is quite liable to breakage if the tail is kept too high when the wheels touch. It is quite possible that this idea might be applied to advantage in a large aeroplane which often lands at strange fields where the propeller is often damaged by tall grass or other obstructions.

In his model, Mr. Galbraith has added an adjustable stabilizer, controlled by means of a thumb screw aft of the tail skid. Another feature of the model is the arrangement of the motor-stick, which is removable with propeller and rubber as a unit. This is done by loosening a screw in the pilot's cockpit, permitting the motor unit to slide out in front.

A 32" Flyng Scale Model of the Verville-Packard Aeroplane, built by R. G. Galbraith

The propeller is laminated from three layers of balsa wood and four layers of thin veneer.

Besides this model, Mr. Galbraith has built a Curtiss J N H 2 from plans published in August, 1920, having an 18-inch wing spread, 2-inch chord. It is provided with dual controls, and although not intended to fly, makes a neat room-ornament.

Model Propellers Tested in Wind Tunnel

Experiments to determine the characteristics of full-sized aeroplane propellers have not, until recently, been successfully conducted by testing model propellers in wind tunnels, owing to the absence of tunnels large enough to accommodate propellers of sufficient size. There are now, however, several tunnels available for this purpose, some having an opening of seven feet, in which the air speed can be brought up to seventy feet per second, giving results of very fine accuracy. The wind-tunnel method has therefore become the most important form of experiment for completely investigating propellers.

Model propellers are usually made about three feet in diameter, and are reproduced in scale to a high degree of accuracy. The propeller is mounted on a shaft located in the center of the tunnel, with its axis parallel to the length of the tunnel. The shaft is connected to the balance instruments located outside the tunnel. Two arms are carried on the balance, one mounted in line with the length of the tunnel, which measures the thrust of the propeller, and the other mounted at right angles to the tunnel, to measure the torque.

In carrying on these investigations the model propeller is revolved at a definite constant speed of rotation. This is to reproduce, at true scale, the effect of a propeller being revolved by an aeroplane engine. The speed of the air through the tunnel is varied from zero to seventy feet per second. This reproduces the effect of the propeller proceeding through the air at that rate of speed; at various speeds of propeller and air, readings are taken of the thrust and torque forces, in pounds. From the information thus obtained, it is then possible to plot the characteristic curves of that particular propeller for the varying conditions of flight.

The effectiveness of the above method is attested by the fact that the results indicated by experiments with a three-foot propeller are similar to the results shown by tests of ten-foot propellers.

Limericks

Large and marvellous is the Caproni,
Even young ones appear over-growni.
If they get any bigger,
What price the poor rigger!
Unless they are braced by Marconi.

A pilot who'd learnt on a Blériot
Always thought he was rather a heriot,
Till someone cried "Steaduet,
I learnt on a Breguet."
Then his pride sank to somewhere near Zeriot.

Whilst rigging a 'bus, an A.M.
Said, "Golly, this 'bus is a gem,
Gott strafe its designer,
I cannot align 'er,
I must wrangle the angle *pro tem.*"

Oh, There's a Great Day Coming By and Bye

Oh, there's a great day coming by and bye!
When jitneys will be running in the sky.
If you want to go somewhere
You will always find one there,
And the fare per mile will not be very high.

Oh, there's a great day coming by and bye!
When bridal couples on a "trip" will fly,
And when sweethearts wish to spoon,
They will fly up near the moon,
Where no one can into their secrets pry.

Oh, there's a great day coming by and bye!
Since man has learned the knack of how to fly.
There's a new field he can range,
And if he should need a change
Of air and scene, the novelty he'll try.

Oh, there's a great day coming by and bye!
When things for man are getting too bone dry.
With some congenial friends
He can fly off for week ends,
And join in singing "Comin' Thru the Rye."

Oh, there's a great day coming by and bye!
When it will be quite "a la mode" to fly.
There will be an "Aeroplane Show,"
To which "tout le monde" will go
To view the latest models of the sky.

Oh, there's a great day coming by and bye!
To be "Flee As a Bird" we'll no more sigh,
For among our other things
We shall keep a pair of wings
For our convenience when we wish to fly.

Rose Villar.

550 West 184th Street, New York City.

Right

Two army doctors, while ballooning, lost trace of their whereabouts, and wishing to know over which part of the country they were passing, saw a rustic at some distance working in the fields, and gradually descended.

When nearly overhead one of them called out:

"Hi, there, John-ny, can you tell us where we are?"

The rustic merely gazed up in much amazement. Thinking he had not heard, one of the officers again shouted out, louder than ever:

"Where are we?"

Just as the balloon drifted past came the answer:

"Whoy, ye be in a balloon, bean't ye?"

What the officers said when they heard this is not recorded.

Indifference

Over my garden
An aeroplane flew;
But nothing there
Either cared or knew.

Cabbage butterflies
Chased each other;
A young wren cried
Seeking his mother.

Gay zinnias
With heavy heads
Flaunted yellows,
And mauves, and reds.

A hummingbird,
On the late larkspur,
Never knew what
Went over her.

Crickets chirped,
And a blinking toad
Watched for flies
On the gravel road.

They don't care
How smart men are—
To go through heaven
In a flying car!

To a yellow bee
On a marigold
The adventure
Seemed a trifle old.

Louise Driscoll.

A group of automobile enthusiasts were bragging about the Indiana roads one day at dinner in an Indianapolis hotel, when a quiet stranger remarked, "Gentlemen, I can drive my machine over any road in Illinois at 60 m. p. h."

A riot was averted by a bejeweled jew rushing up to the stranger, exclaiming: "Come on Alex, you fly in fifteen minutes."

Mr. Smith wasn't an expert mechanic, and even the mention of aviation roused all his fighting spirit. "Did you make this aeroplane?" asked the foreman. "Meaning no harm, I did," said the mechanic, preparing for a skirmish. "It is smaller than usual," replied the foreman. "That's so you will have less to find fault with."

engineering

AERIAL AGE WEEKLY

OL. 13, No. 5 | APRIL 11, 1921 | 10 CENTS A COPY

The Traymore Hotel, Atlantic City, Photographed from a Flying Boat by W. N. Jennings of Philadelphia

Are We Making the Most of Our Government Contracts?

LISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
criptions: Domestic, $4; Foreign, $6. Entered as second-class matter March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

G. DOUGLAS WARDROP
Editor
B. C. BOULTON
Contributing Technical Editor
LESLIE V. SPENCER, M.E.
Contributing Technical Editor
NORMAN E. JENNETT
Art Editor
H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIII NEW YORK, APRIL 11, 1921 NO. 5

ARE WE MAKING THE MOST OF OUR GOVERNMENT CONTRACTS?

THE statement that our army, navy and aerial mail contracts will form the foundation for our aircraft industry during the present year will not be refuted by anyone with the facts in hand, and therefore it is pertinent to ask if we are making the most of our government contracts, having in mind the upbuilding of a sound and substantial industry. A study of recent bids placed with the army for machines to be delivered during the next ten months will prove interesting when we bear in mind that what we want to do in America is to upbuild an industry, and not merely to have machines produced by the lowest bidder.

During the war, every organization that had the machinery and the personnel were anxious to secure aircraft work, and it was necessary that the maximum use of the country's facilities should be used. But with the present limited appropriations every endeavor should be made to favor those organizations who are destined to form the nucleus of our aircraft industry, in order that they may be able to maintain an organization with a permanent personnel, which personnel would in a short time be a very definite asset to American aeronautics.

When a contract is placed with any constructor, an endeavor should be made to give the constructor the maximum time for production. When he is requested to get the machines out in quick order, it requires a temporary increase in his factory staff—a pushing up of the production curve to a high point for a brief period, and then a quick slump when the order is completed, and a disbanding of at least part of the personnel. It is impossible for any organization to get the best out of its staff under such conditions, and it literally puts aeronautics in the realm of "seasonal" business.

If the manufacturer definitely knows that he has twelve months in which to do certain work, he can plan his work economically, increase the working efficiency of his personnel, and firmly establish his organization, and at the same time the government department will benefit because it will be found that appropriations will go further.

We know that companies, not entirely concerned with aeronautics, did excellent work during the national emergency, but we also are firmly convinced that the present is a time when every appropriated dollar should be spent with those companies that are to remain a part of the aeronautic industry.

Aerial Photography

CHAMBERS OF COMMERCE and other public bodies are gradually waking up to the use of aircraft for survey purposes. Strangely the smaller cities and towns are leading the way, and while some of the cities of the first class have had the matter under advisement, none has, as yet, definitely undertaken a complete aerial survey.

In New York various corporations have utilized aerial photographs to show the adventageous location of their bank, office building, hotel, etc., but consideration should immediately be given by our city fathers to having prepared a complete aerial survey of the metropolis.

London, England, is having a complete map prepared, and an aerial mosaic of Edinburgh, Scotland, was recently completed at the request of the Edinburgh corporation in order that a plan of the city might be had at once so that certain points in the boundary dispute between Edinburgh and Leith might be settled. The mosaic was prepared inside three weeks. Only three flights were made and twenty-seven photographs taken. These were enlarged and pieced together, costing the city only $550.00.

A further example of aerial planning will be found in Venezuela, where arrangements have been made for the carrying out of a survey of a vast tract of land, the exploration of which would take about three years and cost about $850.00 per square mile if carried out in the ordinary way. The government, realizing the uses of aircraft, has arranged that the survey shall be carried out by air. The work will occupy only a few weeks and the cost will be trifling compared with that of a regular survey.

The coming season should see many of our city governments interested in this progressive development, and aerial photographic organizations should lose no time in organizing them with the benefits of aerial surveying.

The News of the Week

Unified Air Service Discussed

Washington.—Views which may become the basis of the Harding Administration's aviation policy were exchanged at the War Department, March 31, when Secretaries Weeks, Hays and Hoover and Acting Secretary of the Navy Roosevelt met to discuss the aerial activities and needs of their departments.

As a result of the conference it was decided that in the interest of economy standardization of certain types of machines to be used by the War, Commerce and Post Office departments and unit buying could be inaugurated without injury to the services. At present each department does its own buying and experimental work independently. It was also decided that a standardized plane suitable to the needs of the postal air service and commercial work could be developed along lines that would permit its use as an army bombing plane.

The question of unification of all governmental aerial activities under one bureau or a separate department was discussed, but no decision was reached.

Secretary Hoover is understood to have presented to the conference the need of national aviation laws and rgulations, and it is regarded as probable that a bill incorporating the ideas advanced will be presented when Congress convenes.

Secretary Hays called attention to the number of accidents in the postal air service and suggested that one way to reduce them would be to subject postal mail flyers to the regular army aviation examination and to require them to enter the army Aviation Reserve Corps.

Mitchell and Roosevelt Confer on Air Bombing

Washington.—Brigadier General William Mitchell, chief of the training division of the Army Air Service, conferred with Acting Secretary of the Navy Roosevelt March 30 on the bombing experiments to be conducted by the naval and army aviators. They took up suggestions that the army, or land fliers may be given greater leeway in the bombing experiments. The Acting Secretary indicated that a program satisfactory to both army and navy fliers will be formulated.

Both the Army Air Service and the Naval Aviation Bureau are engaged in experimental work for the bombing tests, which are scheduled for the middle of the summer. The plans call for a mock battle between warships and planes to determine the truth of General Mitchell's contention that aeroplanes were making the battleship obsolete.

First Woman Flyer Crosses the Andes

Santiago, Chile.—Madame Adrienne Bolland, the French aviatrix, flew across the Andes from Mendoza, Argentina, to Chile, April 1. Her flying time was four hours.

Madame Bolland used a 1914 model 80-horsepower biplane and flew at an average height of 4,500 meters. She was the first woman to perform the feat.

New Jersey Passes Aerial Regulations

Trenton.—The New Jersey Senate on March 29 passed a House bill providing that aeroplanes shall not be permitted to fly over audiences at fairs, and athletic events at a lower altitude than 2,000 feet.

New Aerial Unit For Guard

Albany.—Adjt. Gen. J. Leslie Kincaid issued orders on March 27 for the immediate organization of the 27th Air Service at Hempstead, Long Island. It will be composed of the 102d Observation Squadron, the 102d photographic section and the 102d branch intelligence office. The organization will consist of twenty-one officers and ninety enlisted men.

Authority to organize an aerial unit in each National Guard division was granted by the War Department in February, 1920, and specific authorization to organize as part of the New York guard troops the first guard tank company was granted a month later. Final authorization in each case depended upon the passage of the Army Reorganization bills.

The training system in the National Guard units will be the same as the regular army standard system. The guard air force will have the same type machines and other equipment as the United States Air Service. The organization in this State will be the maximum allowed by the War Department.

Great Lakes Airways Organized

The Great Lakes Airways, Inc., an Ohio corporation, has been organized in Cleveland to engage in aerial transportation between Cleveland and Detroit, starting about May 15. Flying boats of the HS-2 and F5L types will be used.

The boats will fly between Cedar Point, Put-in-Bay, Toledo, Pelee Island (Canada), and other islands and resorts on West Lake Erie.

Rex L. Uden is the organizer of the company and he has secured the backing of a number of the leading business men in Cleveland. Uden has had wide experience in flying. He joined the R. F. C. in 1917, became a member of the 208th R. A. F. in France, was honorably discharged in 1919 when he returned to Cleveland. He then organized the Cleveland Aviation Club, and in 1920 organized the Associated Aviation Clubs of Ohio. Governor Cox made him a member of the Ohio Aviation Commission in 1920.

Mr. Uden has associated with him Lieut. A. H. Denison, who was in the Army Air Service during the war, and who, in addition to having excellent flying ability, is a capable executive.

Starts Balloon Inquiry

Washington.—Acting Secretary Roosevelt has started a personal inquiry into the flight of the naval free balloon from Pensacola, Fla., March 22, with five men aboard, which has not since been heard from. The inquiry is preparatory to ordering the usual board of investigation, which probably will not be designated until Secretary Denby returns from Guantanamo, April 5.

Mr. Roosevelt said that the Pensacola affair, coming on the heels of the balloon flight from Rockaway, L. I., to Moose Factory, Ontario, undoubtedly would result in tightening up orders regarding such flights in future.

Editors Visit Naval Air Station

During the recent Southern Conference of National Editors, Governor C. M. Hardee, of Florida, with more than 200 delegates of the conference, visited the U. S. Naval Air Station at Pensacola for an

Photo by U. S. Army Air Service

The Curtiss Eagle Ambulance used by the Army Air Service at Mitchel Field

inspection of the aerial activities of the station. Full honors were accorded the Governor on his arrival. About 40 planes took the air, including a formation of eight twin-motor boats; HS boats engaged in gunnery work; R-6-L's dropping torpedoes, and squadrons of N-9's in acrobatic flying. Three non-rigid airships were in the air at the same time.

The Governor and the delegates expressed the keenest interest in the work at Pensacola and many of the delegates who, for the first time saw large formations of aircraft in operation, expressed as their opinion that should bankers and financiers have an opportunity of observing aerial activities conducted en masse, so to speak, commercial aviation would be greatly benefitted as a result. In other words, if bankers familiarized themselves with the remarkable advancement made in aviation since the war, commercial aeronautics would receive more generous support from financial interests in the country.

The day after Gov. Hardee and his guests visited Pensacola Capt. G. F. Cooper, U. S. N., Commandant of the 8th Naval District, inspected the station. As a demonstration of squadron maneuvers, 42 planes were in the air by 8:55 in the morning, a number greater than all of the aircraft the Navy had in commission on April 6, 1917, at the beginning of the war.

Aerial Tournament at Holdrege, Nebr.

The biggest flying event in this section of the country will be staged at Holdrege, Nebraska, on May 5th, 6th and 7th by the Central Aircraft Company.

The whole program is designed to create and keep awake the public's interest in aviation and to display the various types of ships now being manufactured, for commercial and sport purposes.

The Holdrege Commercial Club will furnish all gasoline and oil free to all ships on the field on May 5th, 6th and 7th and a full tank to start home on.

A big indoor carnival by the American Legion is being held in the evenings of those days and a general good time is planned for all those who attend. Every pilot and aero enthusiast is invited to step in his ship and "hop over to Holdrege" on those dates.

Nichols to Head M. I. T.

Cambridge.—The election of Dr. Ernest Fox Nichols, former President of Dartmouth College, as President of Massachusetts Institute of Technology was announced by the corporation of the institute March 30. He will take office on July 1. Dr. Nichols has been a professor of physics at Yale University and engaged in private research work since leaving Dartmouth.

Dr. Nichols succeeds the late Dr. Richard C. MacLaurin, who died more than a year ago. For the last twelve months he has been director of the physical research at the Nola Park Laboratory of the National Electric Lamp Association, Cleveland, where he is said to have gathered about him a notable staff of scientists representative of every phase of illumination investigation.

During the war he developed valuable optical devices for the Bureau of Naval Ordnance.

Dr. Nichols was born at Leavenworth, Kan., in 1869, and was graduated from the University of Kansas in 1888. He won his master's degree at Cornell in 1893 and his doctor's degree at the same institution in 1897. He studied later at the University of Berlin and Cambridge University.

Americans to Fly to Virgin Islands

Washington.—Two aeroplanes piloted by marine corps personnel will leave Bolling Field for a 2,759-mile flight to St. Thomas, Virgin Islands, as a demonstration of the adaptability of land type aircraft for combination land and water flying, and to map the route. The flight will be made in easy stages, and no effort will be made to establish a speed record.

Major T. C. Turner, commandiing the expedition, and Lieut. B. G. Bradley will be in the first plane, and Lieut. L. H. Sanderson and gunnery sergeant C. W. Rucker in the second.

Stops will be made at Fayetteville, N. C.; Paris Island, S. C.; Daytona, and Miami, Fla.; Havana, Cuba; Camaguey, Cuba; Guantanamo, Cuba; Port au Prince, Haiti; Santo Domingo City, Dominican Republic; San Juan, P. R., and St. Thomas, V. I.

Elimination Balloon Race

Alan R. Hawley, chairman of the Spherical Balloon Committee of the Aero Club of America, announces that the National Balloon Race for the selection of the team to represent America at the Gordon Bennett International Balloon Race in Belgium on the 17th of September, 1921, will be held from Birmingham, Alabama, on the 21st of May, 1921.

The entrance fee is $100.00; entries close May 1, 1921. Cash prizes of $1,200.00 are offered by Birmingham Civic Association, to be awarded as follows: First prize, $400.00; second prize, $300.00; third prize, $200.00; fourth prize, $100.00; fifth prize, $100.00; sixth prize, $100.00.

Gets Back Power of Speech by Aeroplane Trip

Washington—An aeroplane flight at an altitude of 14,000 feet restored the power of speech to H. A. Renz, Jr., 22 years old, and a former soldier, who for eight months had been unable to speak above a whisper. His voice, which left him one night while asleep, was returned to normal within an hour, and when he stepped from the army plane at Bolling Field he was surprised at his own voice saying, "I don't know whether I can talk or not."

Renz, while in the tank corps at Camp Colt, Pa., injured a finger, which failed to heal and finaly was amputated. It is not known whether the infection was in any way responsible for the loss of his voice, but in an effort to recover his speech he also had removed his tonsils and adenoids. Eminent specialists had treated him without result.

As a veteran and beneficiary of war risk insurance, Renz consulted the Public Health Service, and Dr. Charles E. McEnerney diagnosed the case as partial aphonia with paralysis of the adductor muscles of the throat. An air flight to high altitude was prescribed and through co-operation of the army air service, Renz found his voice somewhere in the rarified air above Bolling Field.

It is the first case of the kind on record, Public Health Service officials stated.

Miss Amelia Earhart, of Los Angeles, the latest recruit in the ranks of American aviatrices. She was instructed by Miss Neta Snook

Development of 700 H.P. Model "W" Engine

The Power Plant Section of the Air Service Engineering Division at Dayton, Ohio, is engaged in preliminary tests of a 700 h.p. model "W" aircraft engine. This engine was designed entirely by the Power Plant Section and was assembled in the McCook Field shops. The part comprising the first assembly was made up by various engine manufacturers and delivered to McCook Field for assembly.

The engine is designed to develop 700 h.p. at 1700 r.p.m., and is of the water-cooled "W" type, having 18 cylinders arranged in three rows of six, the angle between cylinder banks being 40°, giving included angle between outer banks of 80°. The cylinders are 5½ bore by 6½ stroke, having four valves per cylinder and provided with welded steel water jackets. As great reliability was one of the fundamental points in the design, provisions have been made for use of four independent magneto systems; although where it is desired to reduce the weight, one or two magnetos may be admitted. Throughout the design every effort was made to secure a strong, reliable construction at a moderate value of horsepower per unit weight. The weight of the completed engine is 1720 pounds when equipped with four magnetos. This weight includes all ignition devices, carburetors, propeller hub, flange and bolts, but does not include any water nor oil.

The tests so far conducted prove conclusively that the engine may be relied upon to deliver the rated horsepower in service, as the power obtained on the dynamometer showed a considerable margin in excess of the required 700 horsepower. Tests are progressing satisfactorily and a surprisingly small amount of trouble has developed so far. As soon as the preliminary power determinations are completed the engine will be put on the 50-hour test to study its endurance.

The National Southern Air Tournament

(*Continued from page* 109)

an hour. This entry was streamlined. The Navy F.-5-L, piloted by Lieut. Snody, came in a close second, on official time.

The favorite of the race, however, was the Aeromarine Cruiser (an F.-5-L) the *"Nina,"* which entered the race with nine passengers aboard. So far as is known, this is the first time in the history of aviation that sightseeing passengers have actually participated in a race. Although the *"Nina"* bore a load fully 4,000 pounds heavier than Kirk's H.-16, and was not streamlined, Capt. Lamb piloted her around the course in the elapsed time of 47:48, or an average of 64 miles an hour.

Lieut. Whitted's Aeromarine-Wright, though handicapped by pontoons, averaged close to 70 miles an hour.

The AIRCRAFT TRADE REVIEW

Aircraft Companies in Southern California

There are now seven aircraft manufactories actively under way in Los Angeles county and half a dozen others preparing to open factories.

The principal "going" manufacturers of aircraft in Southern California other than the Goodyear Tire and Rubber Co., which is one of the world's best known builders of balloons and dirigible airships, are the following local concerns:

The Davis-Douglas Co., 421 Coylton street, Los Angeles, builders of the "Cloudster" type of aeroplane and seaplane, designed by Donald W. Douglas, who designed the Martin bomber and other well-known flying machines.

C. Robert Little, 44 West Green street, Pasadena, builders of the Barnhart twin-motored commercial aeroplane, designed by G. Edw. Barnhart, whose first aeroplane, built locally in 1915, is still being flown regularly.

Western Aircraft & Engineering Co., 1212 East Sixth street, Los Angeles; builders of aeroplanes and engines of their own design. The men in this company, J. McK.-Ballou, V. W. Balzer and Roy S. Gradle, are well-known in aeroplane work and they have established an exceptionally well equipped plant.

Pacific Airplane & Supply Co., 320-330 Sunset avenue, Venice; builders of the various types of the Pacific standard biplane. Their business extends into Georgia, Illinois, Kansas, Wyoming and other parts of the country, demonstrating that this section may be a national aircraft center.

W. D. Waterman Aircraft Mfg. Co., Third street and Sunset avenue, Venice; building biplanes designed by W. D. Waterman, who has been in aviation work in Southern California since 1911.

Catron & Fisk, Venice, who have built and flown the first triplane in this section and now have a large triplane almost ready for test flights.

Navy Designs

The designs accepted by the Navy Department on preliminary examinations include the following: Curtiss, 1; Dayton Wright, 3; G. Elias & Bro., Inc., 1; Professor Klemin, 1; Professor Morse, 1. Out of the above seven designs four will be accepted at the final examination which takes place on May 17.

Davenport Aviation Field Opened

The Davenport Aviation Field at Davenport, Iowa, has been opened for the season with A. G. McMann as chief pilot.

The field will be used for commercial purposes and is located within the limits of the city. The facilities of the field have been offered to the Local Police Department, and efforts are being made to persuade the Mail Service to use it on their Chicago-Omaha route.

Service Station In Dayton

The E. A. Johnson Airplane Supply Company has established a Service Station in Dayton to cater to civilian fliers. They have a large hangar for garage purposes and shop equipment is available for all kinds of repair work on plane and motor.

The owner and manager of the Company is E. A. Johnson, who was instructor in the Army, and test pilot at McCook Field, and later the representative of the Curtiss Company at Wilbur Wright Field.

Insurance Agency Uses Plane

The Folmar Insurance Agency, of Troy, Ala., is using an aeroplane for the delivery of claim checks. Miss Helen M. Downer and Miss Elletta Hydrich respectfully represent the agency on trips of this character.

Are You Supporting The Air Mail?

The speeding up of transportation is desired by every business. Your direct interest in aeronautics must convince you that commercial aircraft provide the surest hope of relieving the rail and water systems of transport of the extra-urgent business.

The most general demonstration of the utility of aircraft is the Aerial Mail. Our pioneering efforts have been copied by European nations not only for immediate value, but as the most economic means of developing the art.

Interest in aeronautics will increase as interest in the Aerial Mail increases. Are you supporting the Air Mail? It needs your support. Will you aid by stamping your mail, "Deliver by Air Mail if Possible"?

Air Service Bids

Cap Screws—Air Service, Procurement Branch, Munitions Building, Washington. —Bids are wanted until 2:30 p. m. April 8, circular 60, for furnishing large quantities of cap screws.

Tilting Furnace—Engineering Division, Air Service, McCook Field, Dayton, Ohio. —Bids are wanted until April 8, circular 21-205, for furnishing 1 crucible tilting furnace with capacity for No. 125 crucible equipped with oil and gas burners.

Electric Drills—Engineering Division, Air Service, McCook Field, Dayton, Ohio. —Bids are wanted until April 5, circular 21-195, for furnishing 4 electric drills.

Oil—Engineering Division, Air Service, McCook Field, Dayton, Ohio.—Bids are wanted until April 5, circular 21-198, for furnishing 100 gals air compressor oil and 100 gals lubricating transmission oil.

Liberty Aero Oil—Engineering Division, Air Service, McCook Field, Dayton, Ohio. —Bids are wanted until April 12, circular 21-204, for furnishing 1,750 gals liberty aero oil.

Benzol—Engineering Division, Air Service, McCook Field, Dayton, Ohio.—Bids are wanted until April 5, circular 21-197, for furnishing 750 gals benzol in drums.

Barrage Balloon Cable—Air Service, Procurement Branch, Munitions Building, Washington.—Bids are wanted until 2:30 p. m. April 14, circular 63, for furnishing 1 length of 8,000 feet barrage balloon cable, tinned 5-32 inches in diameter in accordance with air service specification No. 2124 as revised.

Ed (Strangler) Lewis in the rear seat of his Laird Swallow. In the front seat is his manager, Billy C. Sandow

THE GIANT CAPRONI TANDEM TRIPLANE

THE principal obstacle to the extensive application of aviation as a means of transport consists in the lack of security, in spite of the progress accomplished up to the present time.

Lack of security depends principally on the following points:

(a) The possibility of forced landings on account of motor trouble.

(b) Trouble due to atmospheric conditions.

As regards the possibility of forced landings on account of motor trouble, this difficulty can be eliminated in two ways: either by improving the motors or having reserve motors. Some means must be found of using a duel system as is used in the case of navigation.

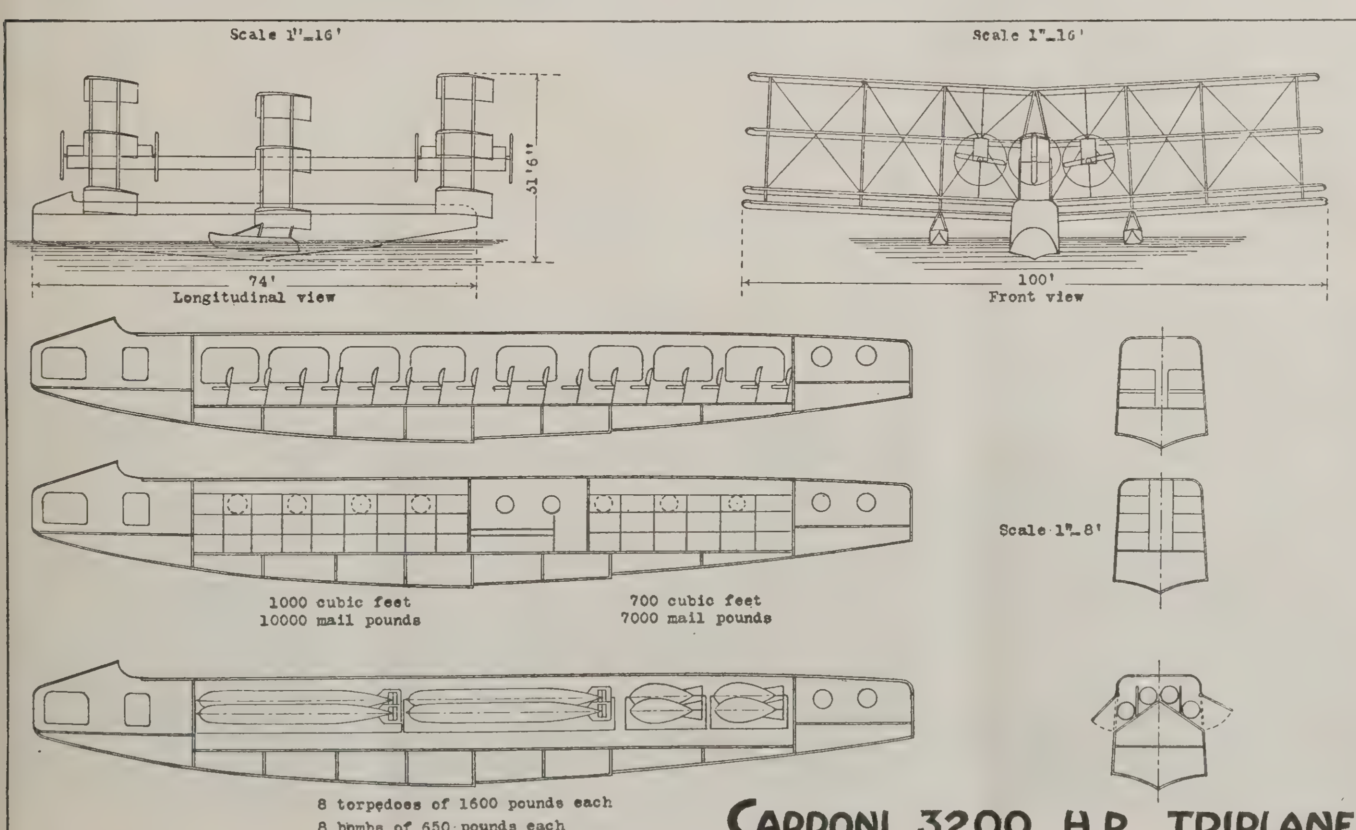
As regards atmospheric conditions, these difficulties can also be eliminated in two ways; either by increasing the stability so as to obtain an apparatus less sensitive to atmospheric disturbances, or by increasing the lifting surfaces so as to have ample support. Also here a means must be found of using a duel system as in the case of water navigation.

If one considers aviation apparatus in its present form consisting of a cell or a principal plane joined to a secondary plane, the necessary technical modifications can be easily recognized for reaching the maximum security.

In fact almost all systems of construction actually in use are subject to certain limitations of technical convenience which render difficult, if they do not impede, the adoption of the necessary cautions and safeguards for the secure operation of transportation for large distances.

While with the forms at present in use it is possible to obtain a certain degree of improvement in the conditions of security, depending on possible betterments in the motors themselves, it is not possible to obtain a great increase in area of carrying capacity so as to obtain those conditions of security which would result from an increase of the stability or from reserve motors.

In other words, in the monocellular system of construction at present in use, and developed by Ing. Caproni in the three and five motor types, the limit of technical convenience has been practically reached for apparatus starting from land and



CAPRONI 3200 H.P. TRIPLANE

also the limit has been approximately arrived at for apparatus starting from water. Beyond a certain point an increase in dimensions, aside from other practical and constructive difficulties, would reduce the useful efficiency and would diminish the relative carrying capacity. It would also increase the unit cost and reduce the possibility of using reserve motors.

If it is desired, therefore, to arrive at an apparatus which will satisfy all requirements of security and practicability for long distance transportation it is necessary to adopt other forms of construction which will allow an increase of dimensions and carrying capacity without diminishing the useful efficiency.

The existence of limits of technical convenience for certain systems of construction is not confined to aviation, but applies in all branches of technical construction.

From this consideration Ing. Caproni was induced to construct a new type of large apparatus which should be the first and most modest example of a new series of air transports.

This consists in a central float 22 meters long which functions as a central pontoon, capable of holding 100 persons in comfort, to which is fixed three triplane elements constituting a total surface of about 715 square meters.

This apparatus is furnished with 8 motors. 4 motors are on the rear set of wings and 4 motors on the forward set of wings. These motors are of 300/400 horsepower each. Each group of motors is controlled by an operator. The pilot can give orders to these operators by means of electric signals. The pilot, however, can also control the motors directly. The system is similar to that used on ships. The weight of the apparatus is about 14,000 kilograms. It has a useful carrying capacity of about 10,000 kilograms with total weight of 33 kilograms per square meter of surface. This apparatus is at present in the Caproni factory at Sesto Calende on Lake Maggiore.

The development of this type has implied the working out of the characteristics common to any apparatus of this type, that is, using the monocellular system of planes in tamden or triplex form.

Some of the specially noteworthy characteristics are the following:

1. Abolition of the tail.

2. Employment of aerlons for longitudinal control as well as lateral.

3. Application of motors in the rear of the apparatus as well as in the front.

4. Application of two small wings between the lateral floats and the central floats in order to facilitate leaving the water.

These characteristics together with the multiplicity of cells give the apparatus an aspect entirely different from those which have been developed up to the present time.

It looks like a boat with wings.

As regards the results which can be expected from the point of view of efficiency, the system of construction adopted is susceptible to criticism, in that the lifting surfaces being placed one in back of the other influence each other in such a way as to diminish the efficiency.

But it must be remembered that all the experience which has been had up to the present time on the reciprocal influence of carrying surfaces, has been obtained with models, and the experience obtained from models furnishes very inadequate data. This has been proved by experiences with ordinary multiplanes. The fact is that the reciprocal influence of surfaces varies with variations of dimensions and that adequate conclusions can be arrived at only by experimenting with a series of models whose elements are in proportional relation. It can be assumed that even in the case of following planes, the reciprocal influnce of the planes is the same or less than that resulting from models. Besides this, the use of following planes has the advantage of reducing the proportional size of certain parts as well as reducing the resistance to passage thru the air.

From the point of view of security, the type adopted tends towards auto-stability and offers ample support to take care of atmospheric disturbance. The piloting of the apparatus for this reason is easier than for ordinary types and therefore, the necessity for a change of pilots is much less. From a practical point of view in addition to the security deriving from the auto-stability above mentioned, there is the advantage of greater carrying capacity, and of reserve motors.

An apparatus of this type can realize the conditions required for the transport of passengers, mail and special kinds of merchandise. It is not desired in this article to discuss the advantages and profits which might be derived from an air system of navigation in competition with water navigation, but attention is simply called to the enormous saving of time which can be obtained in the transport of persons and valuable merchandise by air navigation.

In addition to its commercial aspects, there are other considerations of a political and military nature which will require a great development of aviation. In this age no nation which occupies an important place in the political world can fail to be interested in experimentation and construction of types of apparatus which have such tremendous possibilities.

In fact with these new types adapted for transport the possibilities of bombardment are tremendously increased and also they make possible the actual transportation of troops to a point where they can be most effectively used even within the limits of enemy territory.

Specifications

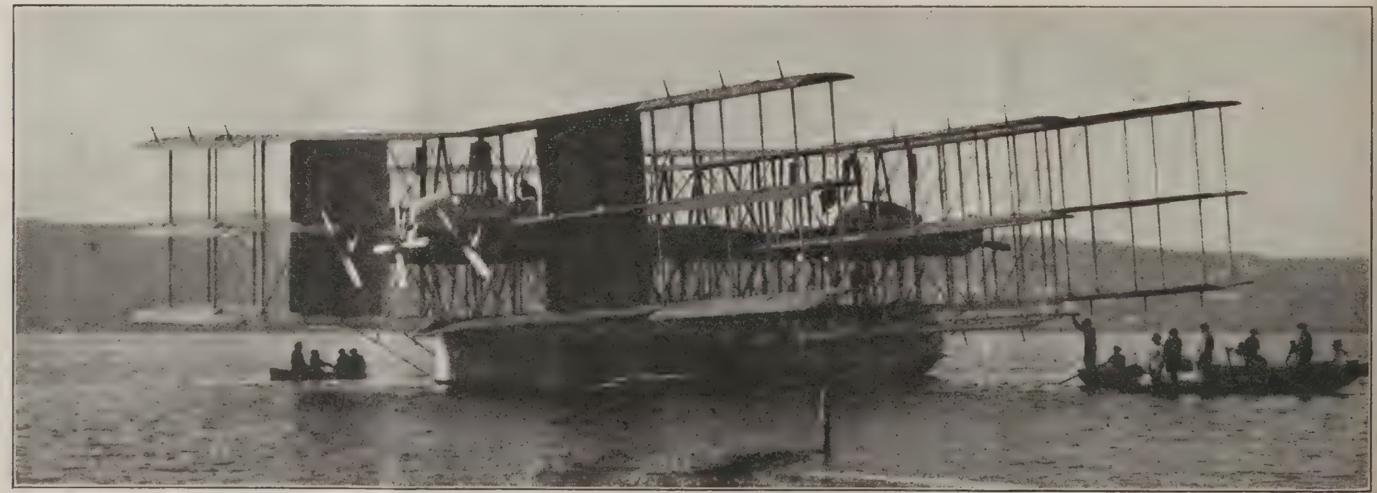
Engines	8
Name Liberty-12	
Normal B.H.P.	400
Total	3200

Dimensions (over all)

Span	100′
Length	74′
Height	31′6″
Chord	8′7″
Gap	8′7″
Wing area—sq. feet	7800

Weights (pounds)

Empty	30000
Useful load	25000
Gross weight	55000
Endurance (with commercial load)—hours	6
Speed (at ground)—(miles per hour)	90



Three-quarter front view of the Caproni 3200 H.P. Triplane

RADIO COMMUNICATION WITH POSTAL AEROPLANES

By J. L. BERNARD and L. E. WHITTEMORE

I. Introduction

THE increasing use of aircraft for military and commercial purposes makes it extremely important to develop methods for communicating between aeroplanes and between aeroplanes and ground stations. The Navy Department; the Coast Artillery, Air Service and Signal Corps of the War Department; the Post Office Department; the Forestry Service; and numerous concerns who are interested in promoting commercial aviation, are actively promoting the development of radio for us in communicating with aeroplanes.

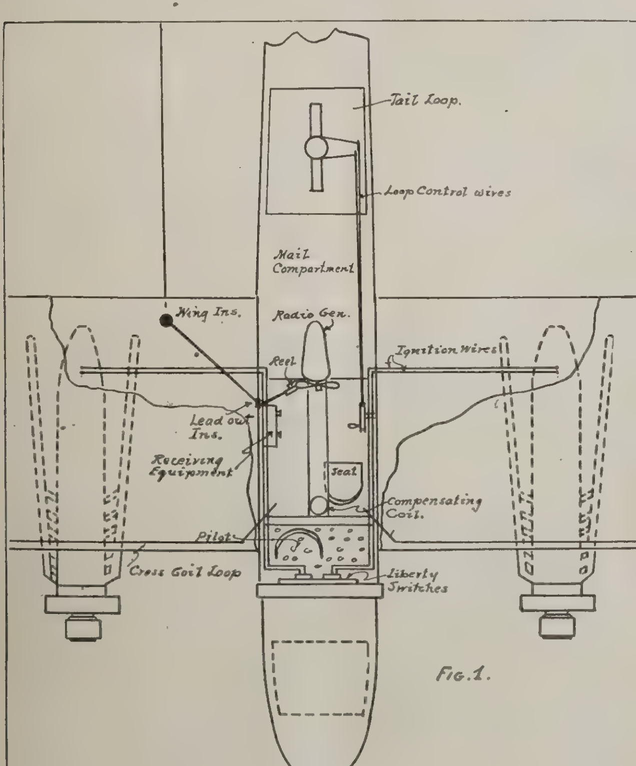
Means of communication are desirable both for ordinary purposes and because of the special conditions under which aeroplanes travel. It is so easy for aeroplanes to wander from their specified course and become lost in storms or in darkness that it is especially important to provide them with means for determining their direction of flight and location with respect to fixed land stations or each other. It is also important to be able to notify the pilot of approaching storms or other special conditions.

This paper deals chiefly with the problems of the Air Mail Service of the Post Office Department and describes a series of experiments conducted in the development of aeroplane radio direction finding and in the production of a special type of signals to enable the pilot to locate exactly the position of his landing field. A part of the work described was done by the Post Office Department and a part was done through the cooperation of the Bureau of Standards and the Post Office Department.

II. Problems of Aeroplane Radio Communication

1. Receiving on Aeroplanes.

The pilot of an aeroplane is interested in receiving radio signals both on account of the substance of the message received and on account of his frequent need to determine the direction from which the message arrives. The problem of aeroplane radio reception is somewhat different in these two cases. In the former case the antenna need not be directional and so may be somewhat simpler and considerably larger. In the latter case the antenna must be specially designed and carefully located in the aeroplane in order to give a true indication of the direction. An antenna used for aeroplane direction finding must necessarily be small and this limits the power which can be received and makes it necessary to use powerful amplifiers as a part of the receiving apparatus. This in turn increases the magnitude of the disturbances caused by the ignition system of the aeroplane. The experiments described are chiefly in connection with directional radio transmission and reception and when the precautions and requirements here stated are complied with one will have little difficulty in arranging in addition an ordinary receiving apparatus on the plane if this should be desired.



The sensitiveness of the receiving apparatus as well as the power of the transmitting apparatus on the ground must be determined largely by the distance over which reliable communication is required. It will also depend upon whether communication is required between plane and plane or between ground and plane, somewhat less power being necessary in the latter case. More power is also required in the case of telephony than in the case of telegraphy.

Several types of antennas have been suggested and used, the particular requirements determining, of course, the choice among these. For directional reception, however, the coil aerial is necessary, unless future experiments with the condenser antenna show that it may be useful as a direction finder or a directive transmitter. Other types, such as the trailing wire or the skid-fin antenna are less satisfactory, the former being quite variable in its constants during the course of flight and the latter being non-directional and in some cases necessarily small.

The reception of radio signals on aeroplanes is necessarily handicaped by interference of two kinds: (1) Noise from the motors and the wind produced by the propellers, which makes it very difficult for the operator to hear the signals unless his ears and telephone receivers are well protected by a helmet; (2) Electrical interference produced in the receiving apparatus by the transient currents in the wires of the ignition system of the motors. Steps which have proven to be effective in greatly reducing these two sources of difficulty are described below. Except in the case of the extremely large planes the space available for the radio apparatus is small, and therefore a compromise must sometimes be made between the apparatus most to be desired and the apparatus which would have a minimum of bulk and weight.

2. Transmitting from Aeroplanes

Under the present conditions it is not usually required that the signals shall be transmitted from an aeroplane in only one direction and therefore the problem of aeroplane radio transmission is not greatly different from that of transmission from a ground station. The chief elements to be considered are: (1) power supply, and (2) design of antenna, and (3) mechanical design of apparatus. The sources of power are either a generator driven by a fan which is placed in the wind stream from the propellers or batteries which may be carried on the plane if the weight is allowable. The antenna must usually be the same one which is used for receiving unless for the latter a coil or other directional antenna is used. On account of the limitation of size of the antenna and therefore the small maximum capacity possible it is difficult to radiate a large amount of power from an aeroplane transmitting station. Transmitting sets are available on the

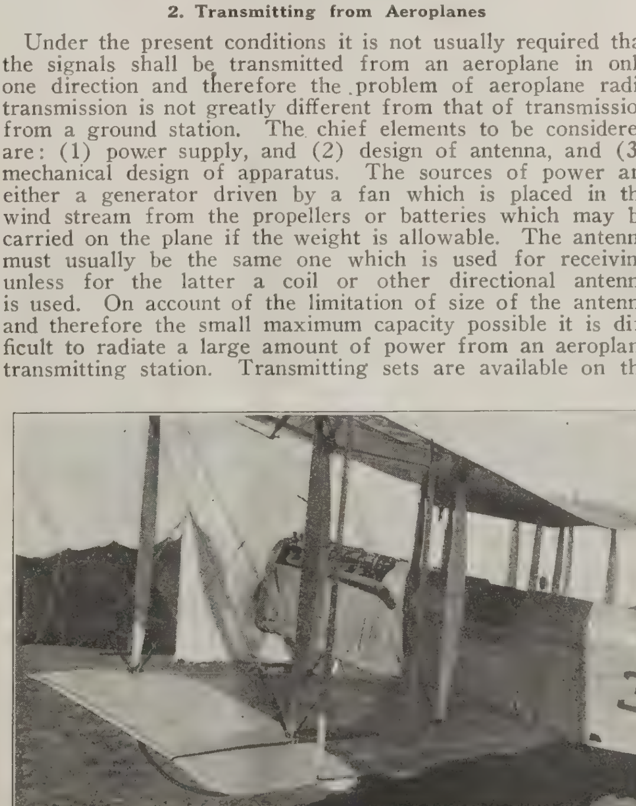


Fig. 2

commercial market which perform fairly satisfactory service. In this connection the decision must only be made as to whether telephone or telegraph signals are desired and in the latter case whether undamped waves or damped waves will be most suitable. The power which can be used cannot depend so much on the distance which it is desired to cover as upon the size of the plane and the resulting capacity of the antenna which it is possible to install. Any deficiency in power must be made up by increasing the sensitiveness of the receiving set. More than usual care must be taken in the design of apparatus which will withstand the constant vibration of aeroplane service. For example, connecting wires should be welded or hard-soldered in place.

In both transmission and reception, especially when direction finding is included with the latter it is highly advisable to provide a special radio operator and not to rely upon the pilot to share his time between the handling of the plane and the receiving and transmitting of signals. In single-motored ships where the pilot flies without additional assistance it is necessary that he handle the radio apparatus himself. This must then be made as simple as possible, the best arrangement for direction finding being the "Robinson method" using coils fixed in position and an automatic reversing switch. This method is described in more detail below. When there are both a pilot and a radio operator a method of communication between them must be provided. Several intercommunicating systems have been developed for this purpose but up to the present time these have not proven to be entirely satisfactory.

III. Radio Direction Finding Experiments On Cleveland-Chicago Mail Route

1. Description of Plane

The planes of the Mail Service on which the experimental work recorded in this section of this report was done, are known as the Martin Mail Planes, of which a general arrangement of pilot's seat, radio compartment, and tail loop is given in Fig. 1. The wing span of the ship is 76', and the separation 9' 6". The useful carrying capacity is approximately 1200 pounds, and the total weight of the radio equipment including the transmitter, radio compass apparatus, storage batteries, etc., amounts to 135 pounds. These planes are supplied with two Standard Liberty engines, have a flying speed of about 85 miles per hour, a cruising radius of 450 miles, and carry a crew of three men, namely—pilot, radio operator, and mechanic.

2. Transmitting Equipment

The transmitting set used was furnished by the Navy Department, and is known as SE-1310, and is a 1 kw. rotary spark gap, air-driven set. This transmitting set was used in conjunction with a trailing wire antenna, and operated on 425 meters at all times. The antenna wire was usually unreeled to 250' and at this length, the current in the antenna was approximately 4 amperes, at 425 meters. The performance of this transmitting set under actual flight conditions for the months of June and July is plotted graphically in Fig. 2. It is to be noted that on June 23 it was possible to cover a distance of only ten miles owing to local electrical storms.

Fig. 3 shows a photograph of the transmitting equipment installed in the radio compartment, showing the antenna reel, transfer switch above it, and to the right, the antenna loading inductance, ammeter and transmitting key. The generator assembly with fan attached contains a 500 cycle generator, power transformer, protective condensers, radio condenser, rotary spark gap, oscillation transformer and wave changing switch.

Fig. 3

3. Ground Compass Station

The fact that the Post Office Department was unable to secure properly trained personnel for the operation of several ground compass stations, made it necessary for those of the radio division to confine their efforts to the study of apparatus on the aeroplanes, but several weeks' test with a single ground compass station at Cleveland revealed the fact that contrary to the general belief, the ground compass is less desirable for this class of work than the rotatable tail coil in the ships. To be of any assistance to aerial navigation, there should be erected between Cleveland and Chicago, four radio compass installations, each provided with some means of communication to a central plotting station, and at the instant a bearing is taken by each of the stations on a ship, it should be communicated to a central plotting station, where the location of the ship can be determined by triangulating. The expense of such an outlay is at once evident, and the exact location of plane is of no particular value, as was determined by comparison of visual and radio observations on a station about four miles away. Several position observations could be made, however, and the general course of the ship determined, but by a properly designed receiving coil on the aeroplane the direction of flight of a ship can be obtained much more quickly.

The employment of direction finding stations on the ground has the inherent disadvantage that the operator who observes the direction is only one of a number of persons concerned with determining the location of the plane, and he is not at all personally concerned with the outcome of any inaccuracy which may result from careless work. On the contrary, the observer on the aeroplane is vitally concerned with the results, care in the accuracy of which may mean saving him from a serious accident.

The observation of direction on the aeroplane gives one simultaneously the direction of flight and the location of the plane. The latter is fully as valuable as the former.

The temporary ground station used at Cleveland is shown in Fig. 4. The frame of the coil is square, and measures 8' on a side. It consists of two groups of windings of four turns each. A switch is provided for connecting the two windings either in series or parallel, which eliminates any unused turns for the shorter wave lengths. The entire receiving equipment is mounted in a waterproof compartment in the center of the loop 7' above the ground. Using a Navy 6-tube amplifier connected to this coil, bearings were taken at noon from the Cleveland field on the Chicago 5 kw. Naval Station, 325 miles distant with an accuracy of one degree, ten days in succession. The compass was erected in the center of the field and was entirely free from any distortion. Directions taken on a ship in the air 75 miles from Cleveland were accurate within ten degrees, and reversed bearings taken on the Cleveland transmitting station from the ship, at the same time, were accurate within about 4 degrees. Local interference from vessels stationed on the Great Lakes, rendered direction finding with the ground compass during June and July practically impossible, since many of these transmitting stations used wave lengths as low as 425 meters, the wave length used by the aeroplane transmitting set. All beacon stations transmitting signals to the mail planes, conducted their work on 1050 meters in accordance with the agreement made between other Government Departments.

(To be continued)

Fig 4

ANALYSIS OF OPERATION COSTS OF AEROPLANE LINES

By WILLIAM B. STOUT

AN aeroplane line, started for commercial profit without knowledge from the beginning of what the costs of operation are going to be, cannot help but fail. With many aeroplane lines starting during the coming season for commercial profit, real study should be put into the figuring of operation cost, that the propositions which are put up to investors may be real and definitely feasible.

An improperly prepared schedule of costs is the worst possible preliminary to sales of any proposition to a man who understands such matters, whereas a properly prepared and carefully worked out analysis is a real asset in promoting any proposition.

The aeroplane industry is so new, and the operation of ships so varied for different services and with different planes and engines, that no definite overhead figures can be taken for any particular line, but these should be figured out separately for the individual case.

The original investment should be given careful consideration and careful study made to be sure that the planes being purchased or under construction, in speed capacity and engine equipment are consistent with the particular service in which they are being put.

The original investment list should include first cost of planes, allowing for a proper percentage of spare planes on the ground and in the shop in repair, a permanent spare stock of at least 25% of this plane investment, and a liberal allowance for fuel equipment, motor vehicles at terminals, hangars, gasoline, storage, etc. Every item of fixed investment should be carefully studied and included, and the amount totalled.

Next may be figured the annual operating expense. This should include insurance of 15% to 20%, depending upon the type of ship. Instead of figuring depreciation, it is customary in aeroplane figures to quote "replacements," since a ship may be flying under a given number long after the original plane has been replaced piece by piece, and nothing left but the number. 50% per year for all-metal ships is ample; in wood and fabric ships, 75% should be allowed the first year, and 25% the second.

Engine replacements should be figured separately on the basis of mileage per day in operation and the number of days per year in service. About 600 flying hours on high-class aircraft engines is feasible, allowing for an overhaul every 200 hours. For cheaper engines, an overhaul every 100 hours is necessary.

The pilot's salary should be figured preferably on a basis of so much per year retainer, and so much per flying mile. Good pilots can be obtained at $2,000 per year, and 5c per flying mile.

Ordinarily, a line is doing exceptionally well if two ships out of five can be kept in the air, even with the extra time allowed for night repairs.

Interest on the original investment should be included at 7 to 10%.

Field personnel depends on how much is figured at each end of the line, and as to just what shop equipment, etc., is used by the operating company or placed out on contract.

With the all-metal planes, hangars for intermediate terminals can be dispensed with and watchmen over the planes be the entire requirement.

Insurance for passengers is ordinarily taken care of by having each passenger sign a waivure, releasing the company from any liability in case of accident. This procedure has not yet a definite legal status, yet it is thoroughly fair at the present state of the industry and would probably be upheld by the Courts.

Fixed annual expense should be totalled and divided in proportion to the number of flying hours per day, during a season of 100 to 300 days, depending upon the service, and a fixed amount of this in proportion allowed for each trip.

Ordinarily, in present-day operation, overhead will run 300% to 600% over the actual gas and oil cost per mile.

Executive costs, even in a small concern, would run about $15,000 per year.

Say a plane is making a three-hour trip and return every day. This gives the plane six hours in the air and a definite fuel cost. Suppose that this line is in operation 200 days: that would mean 400 trips by this plane. The fixed annual cost is, therefore, divided by 400, which gives the per cent attachable to each trip.

Revenue is figured from the number of passengers or pounds of freight and cargo times the price per unit.

The cost per flight, subtracted from this revenue, gives as a result the profit per trip, which, multiplied by 400, gives the profit per year's operation, in the example shown.

This, in general, gives a conservative, rough estimate of what a line over a certain specified route, with certain stops and facilities, would offer as an investment proposition, and gives a good preparation check before going into real detailed figures in advance of actual financing.

REQUIREMENTS FOR ADMISSION TO AIR SERVICE ENGINEERING SCHOOL AT DAYTON

IN order to make efficient use of the time which the regular course in the Air Service Engineering School is allotted, the following are the *minimum* requirements of previous training:

1. Rating as Aeroplane Pilot.
2. Technical and educational requirements. One of the following:
   - *a.* Graduate of Military or Naval Academy.
   - *b.* Graduate of recognized technical college.
   - *c.* A thorough High School education and well versed in the fundamental sciences to the degree outlined below and exceptional experience along lines of special importance to the Air Service.

   Subjects and typical texts, with the equivalent of which the candidate should be familiar.

   The Calculus: (Any text.)

   Chemistry: Elementary college chemistry.

   College chemistry by Alexander Smith.

   Physics: Duff.

   All topics having a bearing on present-day engineering in physics are included, for instance thermodynamics, electricity, etc.

   Theoretical Mechanics: Theory and Practice of Mechanics by Slocum.

   The candidate need only be able to read any part of this text and understand it.

Description of Course of Instruction to be Pursued at Engineering School and Requirements

The applicatory method of instruction in the Air Service Engineering School is used wherever time permits in order to emphasize the fact that engineering knowledge is available in all branches to all of average ability who care to work for it, and that practically all fundamental information may be found written in existing books or documents. Facilities for instruction are unusually complete. In general, the specialists of the Engineering Division are available to carry out the immediate consultation work in conjunction with any particular subject. In each course, the student is provided at the start with a set of instructions, a list of references and a number of problems with methods explained wherever necessary. It is impossible to make experts out of students in any one subject; but the aim is to, at least, arouse the students' interest in engineering reports and data, to point out the extent of each subject and also where the best and most reliable information on these subjects can be found, to effect an appreciation of the engineering problems in aeronautics. It is hoped in this course to develop any latent ability in a student officer for some phase of engineering with a view to a possible specialization along that line in the future with a resultant all-round advantage to the Service. The operation of the School has been mutually beneficial to both the Engineering Division and the student officers themselves thru the exchange of ideas, and it affords a means to a common understanding between the technical and the service organizations.

It is desired to develop personal initiative and mental confidence in this School to such a point that practically no instruction will be required. This is based on the assumption that any problem, the solution of which is dug out by individual effort is much more valuable to the student than a solution in which he is assisted by an instructor. On the first hand, the method of solving the problem is more thoroly learned by the fact that it has had to be accomplished without assistance; on the second hand and by far of the greater advantage, confidence is developed in a student that will go a great way toward rounding out and improving his education.

There certainly is nothing more valuable than the realization on the part of the student that practically all knowledge has been laid down in written books and that this can be obtained by the student by a little personal application. In other words, it is hoped to develop a studious frame of mind so that the student officer after completing the course, will not assume that he has learned all that is to be learned but will continue getting all books, reports, etc., published on aviation and the sciences involved in aviation.

It is hoped that the student officers will get a point of view and a sufficient knowledge to allow them to speak the language of engineering and that a deep interest in mechanical matters will be instilled in them which will result in their returning to their stations with an educational foundation and an interest in technical matters which will cause them to continue reading, studying and constantly improving themselves as Air Service officers. There is nothing more essential and fundamental to an organization such as the Air Service as a studious, ambitious, hard-working personnel that is constantly striving to learn more thoroly the game in which they are engaged. One hour a day devoted to study by every officer in the Air Service would do more than anything else to place the Air Service in a position to make the rapid advances which it should make. It cannot be hoped that the proper development will take place, if all the thinking is done by a small Engineering Division which has no opportunity of getting out into the field and using the equipment which it develops.

The course is not a competitive course. A conscientious application and a good honest effort on the part of a student to get all he can out of the course is the requirement. There is no intention to force any information on any student.

It should be remembered that the course is designed to be of general use to Air officers and not for officers who desire to specialize in engineering, only. It is believed any Air officer will be a better squadron commander, maintenance officer, radio officer, photograph officer or commandnig officer of an Air station for having had the course. There is no obligation to continue in Engineering work.

Synopsis of Course of Instruction

A. Mechanics

The school work opens with a brief review of the Calculus and Differential Equations followed by a considerable number of problems in *Mechanics*. The importance of this course cannot be overestimated. In it, it is intended to bring out to the student officer among other things, the usefulness of preliminary theoretical considerations and to prepare him for courses following, in order to complete which properly it is necessary to depend on the student's familiarity with certain fundamentals at the start. It is also a means to put the student's mind on "the active list" and to enable him to think of his varied experiences since being at school, in terms of the basic principles of all exact science and to refresh himself by problems in the methods of mathematical reasoning. This subject is intended to progressively brush up the student's previous training and to enable the student to get back into the process of careful analysis of all subjects brought before him. The fundamentals of physics are reviewed and the problems are variously very practical on one hand or a means to stimulating thought on the other. The one hundred odd problems lead up to the mathematics involved in airplane stability. Slide rules and handbooks become necessary instruments. Practically all airplane problems in dynamics can in a measure be reduced to the theorems involved herein.

Reference: Slocum, Theory and Practice of Mechanics
Poorman, Applied Mechanics
Fuller and Johnston, Applied Mechanics, Vol. I.

B. Shop Work

Shop Work takes up afternoons in parallel with Mechanics in the mornings and is thus distributed: Machine Tool Work comes in the first three weeks; the second three weeks cover Wood Shop Work; the third three weeks, Metal Construction; and the fourth three weeks (equivalent), General Airplane Construction and Inspection. The set up and method of operation and the limitations of machines and tools used are stressed rather than the completion of any particular piece of work.

(*a*) *Machine Tool*

This commences with bench work in roughing out fittings and incidentals. The following are typical jobs: on the lathe, tapered plug; the shaper, dove-tailed bearing; the milling machine, spiral gear. The uses of other ordinary machine tools are also brought out, such as drill presses, grinders, gear cutters, and so on.

(*b*) *Wood Work*

Actual construction in the wood shop of the main component parts of a standard airplane is undertaken, such as a propeller, a fin, a complete center section, parts of fuselage, chassis struts, making of veneer, varnishing and painting. The storage of wood and the operation of dry kilns are studied. Pattern work is also taken up and rounded out by visits to foundries. The operation of all types of wood machines and jigs for making airplane production parts completes the course.

(*c*) *Metal Construction*

The shop practice on the following subjects is analyzed and the student actually makes such metal parts as are mentioned:

Heat treatment for strength, annealing and hardening.

Welding, general instructions, different types.

Problem: iron box, exhaust header, metal empennage, including tube bending.

Fitting, sheet metal and bench work, jig spot weld and rivet, brazing and complete for inspection.

Fuselage, steel tubing, layout of stock on jig and welding.

Sheet metal work, cowling, metal spinning, tanks, tube bending and soldering.

Fabrication of one complete DR-4 Booster radiator.

(*d*) *Plane Construction and Maintenance*

Internal wiring and bonding, cable splicing, wrapping and soldering are practiced. The center or wing made in the wood shop is covered with fabric by the student and finally doped. This is similarly done for metal control surfaces made. Leather work and upholstering for cowling is undertaken. The final rigging and assembling of a complete machine of each type, (single bay, double bay, twin-engined) is the next problem.

(*e*) *Inspection*

This brief course is commenced by requiring the student to check up gages, jigs and fixtures with the finished product. Problems are then assigned covering inspection work on each of the shop jobs had above, and where possible, work done by the student officers is compared with that of the regular mechanics or shop men. The problem of the aircraft inspector is analyzed.

C. Business Administration

It is intended in this subject to give the student as much information as possible on the subject so that he will be in a better position to operate any organization brought under his control, to advise inventors who come to him with suggestions, as well as to be better posted on a more common ground with the manufacturer of aircraft. Applications of the systems of factory management considered are made in forms of problems similar to those that would come up on installing such systems at a flying field. It is intended that this information would also be very valuable, for example, in case the student were to assume work later as district aircraft production supervisor. Visits to local manufacturing plants are calculated to bring out vital points.

(*a*) *Scientific Factory Management (Shop Engineering)*

Lectures on shop management will be given from time to time in addition to the work laid out as above in problems during a period of shop work, so as to enable the student to work more with his eyes open to the system in vogue at this station. At the end of shop work, full attention is given to the study of a number of problems covering general features of factory organization, application of Taylor's system and methods of handling personnel, etc.

Reference: Diemer, Factory Management.
Kimball, Principles of Industrial Managament.
Taylor, Shop Management.
Principles of Scientific Management.
Jones, Administration of Industrial Enterprises.

(*b*) *Cost Accounting*

General schemes of cost finding are studied from notes, and problems are answered in conjunction therewith.

(*c*) *Business Law.*

A brief summary of the fundamentals of business law, corporations, etc., is studied with a view to pointing out the more obvious legal rights of business men. Reference: Conyngton and Bergh, Business Law.

(*d*) *Patents*

The fundamentals of Patent Law are studied and among other things students are required to draw up a sample application and specification for a patent.

(*e*) *Contracts*

A synopsis of the history of contracts in aircraft production during the war is studied, as well as the present schemes in operation between the Air Service and the manufacturers. The details of sample contracts are studied.

Reference: Shealey, Governmental Contracts (1919).

(*f*) *Civil Service*

The rights and privileges of Civil Service employees are studied briefly, and sources of information on this subject are pointed out.

D. Armament

All phases of aircraft armament as developed up to the present time are considered, including installation in aircraft.

(*a*) *Machine Guns and Synchronizers*

Lewis, Marlin and Browning machine guns are taken up and all parts studied in detail. Different types of synchronizers are studied and actual synchronization of a machine gun is carried out.

(*b*) *Bombs and Flares*

The latest types of these are studied in detail.

(*c*) *Cannon*

37 m.m. is completely dismantled and studied. Types of ammunition used are studied as well as fired.

(*To be concluded*)

THE NATIONAL SOUTHERN AIR TOURNAMENT

THE National Southern Air Tournament, which was held at Belleair Heights, Fla., March 26-27-28, aroused deep interest along the west coast in aerial transport, which promises much toward relieving the entire peninsula of the handicap in communications which it has suffered, and which has greatly retarded its growth.

It is estimated that the tournament was attended or witnessed by nearly 50,000 persons, conveyed by motor car, boat and train from the Tampa Bay region and by aircraft from distant parts of the State.

As a result of the tournament, a Committee for the Advancement of Aviation in the South was formed, consisting of Mayor Charles H. Brown, of Tampa; Mayor Noel Mitchell, of St. Petersburg, and Mayor Frank J. Booth, of Clearwater; Henry E. Snow, president of the Tampa Board of Trade; Lew Brown, president of the St. Petersburg Board of Trade; George E. Washburn, president of the Clearwater Board of Trade; C. H. Freas, president of the Brookville Board of Trade, and Charles M. Hemphill, secretary of the Clearwater Board of Trade and Secretary of the Committee.

The Aeromarine 14-passenger flying boat *"Nina"* of the Key West-Havana Line, Capt. Frank Lamb pilot, made a "round-Tampa Bay" flight for the members of the Committee and carried them to Belleair, where they were entertained at luncheon by Earle E. Carley, vice president of the Belleview Hotel. After a number of addresses, in which the advent of commercial flying was welcomed as greatly contributing to Florida's release from inadequate transportation, Mayor Brown of Tampa introduced the following resolution, which was unanimously adopted and the Secretary directed to act under its instructions:

Whereas, the State of Florida is deficient in transportation facilities, our natural growth being thereby seriously retarded; and

Whereas, the World War and subsequent international developments proved that there can be no security without aviation; and

Whereas, the United States has thus far failed to utilize all the splendid opportunities presented for navigating the air, and has neglected to formulate a national aeronautical policy or otherwise stimulate flying or to increase adequately the aerial arm, now: Therefore, be it

Resolved, by the Aeronautical Conference of Southern Municipalities, held in conjunction with the National Southern Air Tournament, that the Legislature of the State of Florida be and it hereby is petitioned to memorialize the Congress of the United States on the urgent necessity for the adoption and observance of a Federal policy of the Air, and be it further

Resolved, That such Federal Policy of the Air include the enactment of an aerial code, the establishment of air ports, and designation of air routes and the development of signalling and other devices to facilitate safe and regular operation of transport lines, and be it further

Resolved, That, as the air commands both land and water, our aircraft production resources be conserved and our pilots kept in training to the end that the United States may have the protection provided by an adequate Air Force, and be it further

Resolved, That copies of this resolution be sent to members of the Florida Legislature and to the members of the Florida delegation in the Congress of the United States.

The National Southern Air Tournament was participated in by the Army and Navy air services, the industry and the Aero Club of America. The Aeromarine Plane and Motor Co., through the Aeromarine West Indies Airways, Inc., and the Aeromarine Engineering and Sales Co., was represented by Major B. L. Smith in command of the *"Nina"*. The Curtiss Aeroplane & Motor Corporation was represented, through half a dozen civilian ships, by Charles E. Logan and John L. Moran of the Curtiss Southwest Airplane Company. The Gallaudet Aircraft Corp., the Wright Aeronautical Corp. and the Manufacturers Aircraft Association, Inc., were also represented. Seventeen of the contesting planes were equipped with the Wright Engine.

The tournament was held on the splendid grounds of the Belleview Hotel and was aided greatly by Mr. Carley and C. A. Judkins, the manager, who entertained the Army and Navy officers.

At noon on the 27th, Major Ralph Royce, Commandant of Carlstrom Field, brought over 18 planes, he flying a Vought-Wright. An interesting feature of their arrival was the demonstration by Lieut. F. E. Johnson, in a Curtiss-Wright, of the reversible propeller. Johnson stopped in 15 *feet* after touching the ground.

It was well after dark when Major Smith and Capt. Lamb brought the Aeromarine *"Nina"* into port. They covered the 255 miles from Key West to Clearwater Harbor in 3 hours, 15 minutes. At present it requires at least 24 hours to make this trip by train.

About the same time, Lieut. Albert Whitted, who operates a Curtiss-Wright pontoon ship and a Curtiss F. boat at St. Petersburg, flew into port. Whitted has just purchased 12 Aeromarine seaplanes for commercial work. In the winter of 1920-21 he has carried 540 passengers without an accident.

Johnny Green, an old-timer, who has had his 3000 hours in the air, came in from St. Petersburg the next day in his Curtiss F. This winter Green has carried several hundred passengers.

A. Flavell, who operates a Curtiss *"Seagull"* at Belleair and who has carried several hundred people, was already on the scene.

Lieut. John P. Wood, 2620 Main St., Buffalo, came in with a Standard OX. Wood and Lieut. John P. Andrews, also in a Standard OX, started from Buffalo June 13, and since then they have flown 1200 men and women.

Messrs. Logan and Moran in a Standard C-6 flew in from Pablo Beach and Geo. W. Haldeman and Ray Lockwood, parachute jumper, came in a Curtiss OX from Lakeland.

Early Sunday the Navy participants arrived. They brought a new F.-5-L. and a new H.-16, the latter streamlined. The party was under command of Lieut. A. P. Snody. With Snody in the F.-5 were Lieut. Comm. G. P. Brown and Lt. Hugo Schmidt. In the H.-16 were Lt. G. Kirk and Lt. L. Hundt. The Navy covered the 325-350 miles from Pensacola in six hours, fighting stiff headwinds. Lieut. Snody reported that C. R. E. J. E. LeDew on the H.-16 was in constant radio communication with Pensacola Naval Air Station, breaking the H.-16 record by 100 miles.

Saturday's feature was the 50-mile Southern Air Derby over a 20-mile triangular course. The race was won by Lieut. Victor D. H. Strahm, an ace, in a DeHaviland, in 51 minutes flat. There were nine starters, four DeH's with Liberty Engines, three Nieuports with Gnomes and two Spads with French Hispanos. The Nieuports and Spads were forced out of the race by overheated engines. The weather was extremely hot even for this time of year in Florida. A silver cup, offered by the Belleview Hotel, was presented to Strahm that evening. Here is the official record:

Plane No.	Pilot	Type of Plane	Total Elapsed Time min.	sec.
1	Major A. H. Gilkeson	DeHaviland	55	30
2	Capt. C. W. Ford	DeHaviland	53	28
3	Lt. J. G. Williams	DeHaviland	51	30
4	Lt. V. D. H. Strahm	DeHaviland	51	

On Sunday there was exhibition flying and passenger carrying. The Aeromarine *"Nina"* carried the leading banker and his office force on one trip. A young couple with a 10-months old baby flew on another occasion. The baby slept throughout most of the flight; the roar of the Liberties, muffled by the cabin, did not disturb the child. Nor did the parents have the slightest fear.

Lieut. R. U. Cronau in a Curtiss-Wright won the landing to a mark contest. His wheels were but 28 inches from the center of the circle.

Ray Lockwood did a parachute jump at 1000 feet, winning the cup. Corporal Hill was second and Sergeant Webber third.

Major Royce stunted in his Vought-Wright. There were formation stunting by the Curtiss-Wrights and acrobatics by the Nieuports.

A complete list of the Air Service representatives follows:

Major Royce, Officer in Charge.
Major H. C. Clagett, Air Service Officer, 4th Corps Area.
Major A. H. Gilkeson, DeHaviland.
Capt. C. W. Ford, DeHaviland.
Lt. J. G. Williams, DeHaviland.
Lt. Victor D. H. Strahm, DeHaviland.
Lt. C. W. Clark, Nieuport 28.
Lt. J. D. Corkille, Nieuport 28.
Lt. O. A. Gottschalk, Nieuport 28.
Lt. A. Dunlap, Spad 13.
Lt. C. W. Woolsey, Spad 13.
Lt. C. C. Chauncey, Curtiss-Wright.
Lt. H. McClelland, Curtiss-Wright.
Lt. A. Patrick, Curtiss-Wright.
Lt. C. Fishback, Curtiss-Wright.
Lt. R. U. Cronau, Curtiss-Wright.
Lt. F. E. Johnson, Curtiss-Wright, reversible propeller.
Lt. H. K. Mallory, Curtiss-Wright, Red Cross.
Lt. E. R. Frost, Curtiss-Wright.
Lt. S. E. Eaton, Jr., Information Officer.

Seaplane races over a ten-mile triangular course, starting and ending at the Belleview Pier, featured the closing day of the tournament. Two F.-5-L's, one H-16 and the Aeromarine pontoon ship, with Wright engine, were entered. The H.-16, of the Navy, piloted by Lieut. Kirk, won the event in 41:23 elapsed time. The boat carried three men besides the pilot. The official time was at the average of 73 miles

(*Concluded on page* 101)

FOREIGN TECHNICAL DIGEST

Trial Flights and Acceptance Tests for New Types of Aeroplanes

The ideal test pilot is, or should be, the designer of the machine. Unfortunately, this combination is very rare, and the designer has usually to rely on the reports of others as to the properties of his machine. Until reliable recording instruments are in our possession, the "personal element" will predominate in the tests and "scientific" pilots are not always available.

The following are the main characteristics which an aeroplane should possess, and on which the test pilot should concentrate his attention:

Getting Off.—The machine should possess sufficient directional stability while running along the ground. As soon as the flying speed is reached it should get off without the use of the elevator.

In Flight.—There should be no hunting, either in the horizontal or the vertical direction. The changing over from "power flight altitude" to "gliding flight altitude" should be automatic and quick. Even at the smallest flying speeds wing flap controls should be possible. When executing curves there must be no tendency to go into a nose dive or spin. When sideslipping the machine should still be controllable. All rudder organs should be properly balanced.

Landing.—Smooth landing depends very much on the type of landing wheels and their position. By proper construction, any tendency to leave the ground again can be checked. (A. G. H. Fokker, *Het Vliegveld,* Jan. 1, 1921. 3 cols.)

Construction of Gliders

The following is a description of the glider made by the Aeroclub of Aachen, which won first prize in the recent Rhön competition. It is a monoplane of wooden cantilever construction, with a span of 9.25 metres. Great care has been taken to reduce head resistance to a minimum. There is no external wiring, and the landing chassis is enclosed in a stream-line casing. Fins and rudders merge gradually into the main body, a most important point for a good stream-line form. The wings are of very deep section, the chord tapering forward the tips. Their total area is 15 sq. meters. They are set at a very pronounced dihedral, and, as a covering, very fine voile is used, rendered waterproof by means of a special collodion dope. This covering weighed only 90 gm. per sq. meter, and was capable of resisting a load of 6 kg. per em.^{2} For transport purposes the tail part of the fuselage can be disconnected. The weight of the glider is 62 kg. With the pilot this corresponds to a surface loading of 8½-9 kg./sq. m. The machine possesses the right amount of stability and yet responds quickly to the control (two wing flaps are fitted). The view for the pilot is excellent, and altogether the glider can be considered as a very successful schooling machine. (*Flugsport,* Nov. 10, 1920. 2½ pp., 3 diagrams.)

The Fairey "Titania"

The Fairey boat is, as regards its boat hull, of Linton Hope design. It will be remembered that the late Maj. Linton Hope was, up to the time of his death a few months ago, connected with the Fairey Aviation Company, for whom he did a good deal of very valuable work. Although his designs have often come in for criticism, there is no doubt that the late Maj. Linton Hope had an "eye" for boat design, and the P type of hull, with its circular cross section and flexible construction, has already proved its merit in boats of smaller size than the "Titania." That it will prove equally successful in the large machine there is no reason to doubt. The "Titania" is equipped with four Rolls-Royce "Condor" engines driving tractor and pusher screws. The weight of the machine is in the neighborhood of 15 tons, and the wing span is about 140 ft., so that the machine is certainly not a small one. One effect of the large size is to increase the fuel capacity, which, as a matter of fact, is sufficient for a cruise of 1,500 miles. The size of the hull is such that good seaworthiness may be expected, and consequently the boat should be able to remain afloat for considerable periods at a stretch, taking on board fuel while "sitting" on the sea. It should thus be able to accompany the fleet for weeks, taking its fuel from one of the ships and riding on the sea when not working. It should even be possible to make minor engine repairs without going into dock, at any rate on more or less sheltered waters. If the new machine proves a success, which there is at present no reason to doubt, it or similar types should be able to do a god deal of the work which has hitherto been thought the province of airships. The main drawback to seaplanes has hitherto been their relatively short radius of action, but with a range of 1,500 miles, the machine becomes useful for long-distance sea patrol. If we had had a number of these boats in commission during the war, the air patrol of the North Sea would have been a different affair.

The wings are of orthodox design, that is to say of orthodox Fairey design, incorporating the Fairey Patent camber gear, in which the entire trailing edge is pulled down, thus forming a deeply cambered section, giving high lift and low landing speed even with heavy wing loading. The *ailerons* move with the rest of the trailing edge, but retain their differential action.

The armament of the "Titania" will, in addition to a useful "nest" of bombs, consist of a number of machine guns, so as to reduce to vanishing point the "blind spot" of the machine. Some of the machine guns will be placed in various positions on the wings, so that an attacking aeroplane will find some difficulty in getting to close quarters with the "Titania." The crew wil consist of about seven, so that a fair number will be available for manning the guns, and the old German stunt of attacking in great numbers would probably prove of little avail with machine gunners distributed all over the boat and wings. The "Titania" is now being finally erected and the trial flights will, it is hoped, take place within the next month or six weeks. (*Flight,* March 10, 1921.)

Lighting Installations for Night Flying

Various kinds of lighting installations are required for night flying. Aerodromes must be furnished with beacon lights to enable them to be located by pilots, with searchlights and landing lights to illuminate and indicate landing places, with lights to illuminate repair and workshops, and with alarm signals. In addition, aerial routes should be marked out by distinctive lights on the ground.

The writer describes a beacon light manufactured by Julius Pintsch, Ltd., Berlin, in which a 4,000 candlepower halfwatt lamp is placed at the focus of a searchlight lens of 6.30 mm. diameter. An inclined mirror rotating about a vertical axis reflects the beam from the lens in a vertical band extending from the horizon to the zenith. By causing the mirror to rotate at a given rate, the locality in which the aerodrome is situated can be indicated according to pre-arranged signals. This beacon is visible for a radius of about 80 kilometres.

Another type of beacon is described in which a large number of small lamps are arranged round a central conical reflecting surface.

For the indication of landing places the above-mentioned firm has patented an arrangement of lights in which eight lights are distributed round a central light in such a manner as to indicate the main points of the compass. All these lights are sunk below the level of the ground. An additional set of lights indicates to the pilot the direction of the wind near the ground. (*Illustrierte Flug-Welt,* Nov. 24, 1920. 4 cols., 5 figs.)

Soaring Flight

The recent experiments with gliders in the Rhön district of Germany has given a great impetus to the study of soaring flight. Such a flight can only be rendered possible by the utilization of the energy contained in air vortices, such vortices having large dimensions compared with the size of the glider. Soaring flight is not perpetual motion. Work is gained at the expense of the vortex, whose rate of dissipation is thus increased. Suitable vortices can be met with near mountain ranges or the sea coast. They also occur at altitudes between layers of air moving at different velocities in different directions.

By suitably manoeuvring with the glider from one air current into another, prolonged flight would be rendered possible. This would call for extreme ease of control. In this direction much remains to be accomplished.

Work should be concentrated on improving certain known types rather than on experiment with new designs, so that the pilot shall get some gliding experience without being disheartened by too frequent mishaps. It must always be remembered that at the present time the glider is in the position of an aeroplane executing a forced landing, so that the better the pilot knows his machine the greater the chance of producing results. (W. Klemperer, *Flugsport,* Nov. 10, 1920. 4pp., 1 fig.)

NAVAL and MILITARY AERONAUTICS

Panama Canal Defenses

In working out plans for the defense of the Panama Canal, the utmost cooperation obtains between the Coast Artillery at Fort Randolph and Naval Aviation at the U. S. Naval Air Station, Coco Solo.

During the season's coast artillery target practice kite balloons from Coco Solo were used for shot-spotting purposes with unusual success.

In working out its problems, the Army had considerable difficulty in getting accurate information to the plotting room quickly enough to be of real value. Accordingly, a telephone line was rigged from Fort Randolph with about two miles of wire, which was attached to a Navy kite balloon operating from an EAGLE boat. Another EAGLE boat towed a suitable target, and with the aid of an Army field-telephone kit, excellent communication was maintained between the kite balloon and the plotting room at Fort Randolph.

For several days the big gun firing from the Fort was practically controlled from the kite balloon, there being an Army officer in the balloon in charge of the spotting most of the time. Navy spotters, however, were given valuable practice and several of the pilots at Coco Solo have become particularly efficient as coast artillery spotters.

Our Crew To Train In R-80

Washington.—The Navy Department has been advised by the British Air Minister of the activity of the new rigid airship R-80, and officials declared that this will make available additional training facilities for the crew oft he rigid airship ZR-2, being built in England, and now nearing completion, for use by the United States Navy. When completed the ZR-2 will be brought to the United States under its own power by officers and men of the American Navy now being trained in England for that purpose.

The R-80 was built for England by Vickers, Limited, at Barrow, and has just been flown by the British Royal Air Force to its hangars at Howden, Yorkshire, the same station at which the American naval fliers are making their training flights. The American personnel up to this time have been using the wood frame rigid airship R-22 for training purposes.

Major Geiger Transferred

Major Harold Geiger, former commanding officer at Ross Field, has been ordered to Washington for temporary duty. It is understood he will soon sail for Holland where, at The Hague, he will be lighter-than-air military attache of this government. Lieut. Col. Theo. Baldwin is the new commander at the Arcadia balloon school.

Lieut. MacCready in Accident

Ithaca, N. Y.—Lieut. J. A. MacCready, United States army test pilot, from McCook's Field, Dayton, Ohio, fell 9,000 feet in a disabled aeroplane here March 30, and when the wreckage had been cleared away he was found hanging from his seat, shaken and bruised but otherwise uninjured.

The aeroplane crashed on the Thomas-Morse aviation field near Cayuga Lake. It landed upside down, and witnesses of the accident expected to find the aviator dead. Lieut. MacCready said he had ascended to an altitude of 10,000 feet above the field and was going into the first dive of the descent when there was a report like that of a gun. He started the engine to climb out of the dive, but the aeroplane failed to respond to the pull of the propeller and plunged earthward.

The Late Lieut. W. D. Coney

Natchez, Miss.—Lieutenant W. D. Coney, who was injured near Crowville, La., while attempting a transcontinental flight from Jacksonville, Fla., to San Diego, Cal., died here March 30.

The Lieutenant's back was broken in a fall, and complete paralysis of his body from the chest down resulted.

He was attempting to lower his previous record of twenty-two hours, twenty-seven minutes, actual flying time, from coast to coast, when forced down by engine trouble.

Lieutenant Coney was a resident of Brunswick, Ga., and saw service on the Mexican border in 1916. During the World War he was a flying instructor in the Army Air Service. He was 27 years old.

Plans for Air and Sea Battle Nearly Completed

Washington.—Complete details of the bombing experiments to be conducted by the navy aviation service, in conjunction with the army air service, will be announced definitely early next week, Acting Secretary of the Navy Roosevelt announced.

During the last few days officials of the army and navy air service have been going over the tentative program of the tests which are to be held this summer with a view to modifying them so that the land fliers of the army may participate more effectively.

In preparation for the bombing experiments, which are expected to provide a definite answer to the much discussed question of whether the airship is superior to the battleship, army and naval aviators have been participating for the past month in a series of tests at Langley Field, Virginia, and at the naval aviation base at Yorktown, Va.

A specimen of the Monthly Calendar prepared by the School of Aerial Photography at Langley Field

Altitude Tests at McCook Field

Lieut. J. A. MacCready, pilot, and Roy F. Langham, observer, have been doing considerable high-altitude flying. They are using a LaPere biplane, equipped with a 400 horsepower Liberty motor. The engine is fitted with a Moss supercharger, and due to this, very satisfactory results are produced. Lieut. MacCready and Mr. Langham made a flight on March 15, 1921, leaving McCook Field at 10:05 and returning at 12:20, reaching an altitude of 30,000 feet. A temperature of 39 degrees below was encountered at the ceiling, with a ground temperature of 43 degrees.

The weight of this aeroplane is 480 pounds more than the weight carried to 31,800 feet by Major Schroeder in 1919, when he brought back the two-man altitude record.

This flight, together with other high-altitude flights recently made at McCook Field, are an indication of the reliability of the high flying equipment, and a new record may be expected when a plane is trimmed down in weight and advantage taken of every possible factor that contributes to a record climb.

Quintuple Parachute Jump

On the morning of March 9th a five-man parachute jump was made without mishap at Mather Field, Sacramento, California. It is believed that this is a record jump as the descent was made from an altitude of 2100 feet. The plane was a DeHaviland 4-B, piloted by Lieut. Kiel, of the 91st Aero Squadron, who deserves much credit for his handling of the plane to that altitude. The jumps were as follows:

Lieut. Eugene C. Batten, 91st Aero Squadron (in rear cockpit).

Sergt. Richard L. Thorne, 9th Aero Squadron (Left lower wing).

Corp. Paul M. Conners, 91st Aero Squadron (Right upper wing).

Pvt. Earl D. Woodgerd, 91st Aero Squadron (Left upper wing).

Pvt. Alewis Hartner, 91st Aero Squadron (Right lower wing).

The jumps were made almost simultaneously, each jumper first receiving his signal from Lieut. Batten in the rear cockpit. Each of the four men on the wings were pulled off by their parachutes, Lieut. Batten jumping from the cockpit after the others were off. The jumps were perfect and all reached the ground together. Motion pictures of the event were taken from another plane.

FOREIGN NEWS

Some French Civil Flying Figures

Last week-end at a gathering of about forty French Senators at La Bourget at the invitation of the new Under-Secretary for Aviation, M. Eynacr, during a short speech, said 1919 was a year of plans; 1920 a year of trial, and 1921 would be a year of realization. Some suggestive figures were given in a summary of the French air position by Colonel Saconnet, director of the aerial navigation service, who also spoke enthusiastically of flying in France. He detailed the following comparative figures showing the increase in traffic on the Paris-London-Brussels, Bayonne-Bilbao, Toulouse-Casablanca, Paris-Cabourg routes.

Complete journeys, 1911, 173; in 1919, 4,473; in 1920, 4,428. The number of miles covered in 1919 was 333,823, and in 1920, 989,272.

The number of passengers carried in 1919 was 729; and in 1920, 6,697.

Goods weighing 31,680 lbs. were carried in 1919, and 277,319 lbs. in 1920.

Mails weighing 1,048 lbs. were carried in 1919, and in 1920, 13,581 lbs.

He was also reassuring about the high degree of safety which had been reached, and pointed out that for 1,212,309 miles flown there had been only fourteen accidents and five deaths during the last two years. He also mentioned that one can fly from Paris to Warsaw via Strasbourg in twelve hours, whereas the train journey usually takes three days and two nights, and the price, when one includes the cost of sleeping-car accommodation, is no lower than the cost of going by air, which is about £20.

Air Mail to Morocco

No doubt by reason of the generous subsidy by France to French civil aviation the British Postmaster-General is able to announce the reduction, beginning on March 3, of the special air fee payable, in addition to ordinary foreign postage, on packets posted in this country for Morocco, and intended to be forwarded by the French Air Mail Service from Toulouse to Casablanca. The limit of weight per packet has, on the other hand, been increased. The new rates will be as follows:

For packets weighing up to ½ oz., 5d.; from ½ oz. to 3½ oz., 11d.; for each additional 3½ oz., an additional 6d., up to a maximum weight of 17½ oz., and a corresponding fee of 2s. 11d.

The air mail is due to leave Toulouse at 7 a. m. on Mondays, Wednesdays and Saturdays, and to reach Morocco the following afternoon; and the latest time of posting to connect is 3 p. m. (printed papers, commercial papers and samples, 2.30 p. m.), at the General Post Office, London, on the preceding Saturday, Monday or Thursday, and at corresponding times elsewhere. The mail aeroplanes call at Rabat on the way to Casablanca.

International Fares to be Reduced

Another result of the Continental civil aviation subsidies is echoed in the following decisions, arrived at on February 28 in Brussels by the International Conference of the principal aërial transport companies there assembled:

(1) To make a substantial reduction in charges, particularly in the case of passengers, so that they shall compare favorably with the maximum rates charged by the railway companies for international traffic.

(2) To open on April 14 an aerial route between Paris, Brussels and Amsterdam, with a subsequent extension to Copenhagen via Bremen and Hamburg.

(3) To arrange for the London-Brussels service to call at Ostend during the season.

Noted Flyer Killed

Lieutenant MacIntosh, who last year flew from England to Australia, was killed in an air accident at Pilbara, 300 miles northwest of Perth, on March 28.

Lieutenant MacIntosh's mechanic also was killed and a passenger in his machine was badly injured.

Berlin Fights Air Embargo

The German government, replying to an inquiry of the Inter-Allied Aeronautical Control Commission as to whether manufacturers of aeronautical material still were supported by the German authorities in their continued violation of the Entente's Boulogne decisions regarding the construction of such material, proposes that the matter be referred to arbitration.

In this communication the German government states that it still adheres to its standpoint that the Versailles Treaty did not give the Allies the right to prolong the embargo on the manufacture and importation of aeronautical material beyond July 10, 1920.

New Bohemian Aviation Company

From Prague it is reported that a new aviation company has just been established there. The firm, which is known as the Fales Aviation Company, will, it is stated, deal, in addition to ordinary passenger and goods conveyance, with aerial advertising, cartography, aerial photoplay and cinematography. Thus again, Bohemia shows her appreciation of the possibilities of aviation, and makes one more step towards her cherished ambition of making Prague a great aviation centre for central Europe.

Aeroplane System to Link Bagdad With Jerusalem

A regular air service will be established soon between Jerusalem and Bagdad, according to a Cairo dispatch today. A party of aviators has left Cairo to select sites for aerodromes and landing places along the route.

Flying Machine on the Alberto Wick Principle

This invention consists of a flying machine which can rise vertically and move horizontally either backwards or forwards at any speed from zero up to the maximum for which the machine might be built; it can also turn around to the right or left whether the machine be moving horizontally or vertically or stationary in space. Absolute stability is maintained, and should the engine stall, the machine could plane like any regular aeroplane, but with the advantage that it can land at a lower speed than the others.

Any expert may make the dynamic, static and resistance calculations and prove it is possible to construct a machine with a decimonormal breaking strength and weighing approximately 450 kilos, including 100 kilos for a 50 h.p. engine with accessories, using in its construction hardened aluminum, first quality steel and fabric for covering wings and rudder. Such machine would be capable of lifting more than 700 kilos, leaving a margin of 250 kilos, which would suffice for taking two passengers together with sufficient combustible and lubricant for effecting a long trip. By changing in some ways the dimensions and arrangement prescribed in the drawings, it would be possible to obtain somewhat better results than those hereinbefore mentioned. Obviously, the use of a more powerful engine would give greater results; the above example is merely given to give an idea of the invention. The driving of the machine is extremely easy, anybody being able to manage it. Copies of drawings and specifications can be obtained at the Patent Office of Berne, Switzerland, where they have been sent for the registration of the corresponding patent.

An Agreement Between Great Britain and Denmark

The Danish Foreign Office announces that an agreement was signed between the Governments of Great Britain and Denmark on December 23, 1920, *re* the traffic of private and commercial aircraft of both countries over the respective regions. Prohibited areas are permitted for military or public safety reasons and aircraft airworthiness.

Pilot certificates and log books are prescribed. A wireless installation may only be carried with special permission. The authorities of both countries are entitled to investigate the passenger and goods lists on starting and landing.

Aircraft leaving or arriving in Denmark must, for the present, use the Christianshaven drill ground (for landgoing aircraft) or the flying-boat station (naval), while Lympne, Croydon and Cricklewood are available in England for landgoing aircraft and Felixstowe for naval aircraft. The Danish frontier may be crossed everywhere, the British one only between Folkestone and Dungeness, for landing aircraft, or between Orfordness and the Naze for seagoing aircraft.

British Conference on Cross-Channel Services

Lord Londonderry, Under-Secretary for Air and chairman of the newly-appointed Cross-Channel Subsidies Committee, on March 10 presided at a conference, with representatives of the aircraft industry, at the Air Ministry on the question of the future of Cross-Channel Air Services. The other members of the committee, Sir Frederick Sykes, Controller-General of Civil Aviation, and Sir James Stevenson, Bart., were also present.

Among those present at the conference were: Brig.-Gen. F. H. Williamson (G.P.O.); Mr. H. White Smith (Bristol Aeroplane Co.), Commander Bird (Supermarine Aviation Co.); Mr. Parker (Messrs. Shorts, Ltd.), Mr. C. V. Allen, representing the Society of British Aircraft Constructors, Ltd.; Capt. de Haviland and Col. Marsh, representing the Royal Aeronautical Society; Mr. Handley Page and Mr. Cogni (Messrs. Handley Page, Ltd.), Maj-Gen. Sir W. S. Brancker, Mr. G. Holt Thomas, Col. F. Searle (Air Transport and Travel, Ltd.); Brig.Gen. Caddell and Capt. Acland (Messrs. Vickers, Ltd.), Capt. de Valda (Adastral Air Lines, Ltd.), Mr. G. H. M. Kennedy (Air Post of Banks, Ltd.), Major Patrick (Bermuda and West Atlantic Aviation Co., Ltd.), Mr. Rhodes (Blackburn Aeroplane Co.), Mr. Haydn White (Commercial Wing Syndicate), Messrs. Instone (Instone Air Line), Capt. Ward (William Beardmore and Co.), Mr. Lord (A. V. Roe and Co.), Mr. Fulton (Messrs. Martinsyde, Ltd.); Lieut-Col. W. A. Bristow (Messrs. Ogilvie and Partners), Capt. D. M. Greig (Air Express, Ltd.); Mr. Lovibond (Lep Aerial Travel Bureau), Representatives of the Westland Aircraft Works (Messrs. Petters), Mr. A. E. Baxendale, Col. Basil Foster, Mr. Elder-Hearn, Mr. Harold Hurbin and Mr. Ingram.

Educational Advisers to the Royal Air Force

The Air Ministry has appointed Col. I. Curtis, M.A. (Cantab.), to be Educational Adviser and Capt. B. H. Sisson, B.A. (Cantab.), to be Assistant Educational Adviser to the Royal Air Force.

Col. Curtis, the first holder of the post of Educational Adviser, is an associate member, Institute of Mechanical Engineers. He has wide educational experience, having served on the staff of the City Guilds Central Technical College, South Kensington, and the Royal Naval Engineering College. Later he occupied the position of Naval Instructor in the China and Mediterranean stations, being transferred in 1903 to the Admiralty as General Assistant to the Director of Naval Education. In 1909 he became Deputy Director of Naval Schools, a post he held until, on the formation of the Royal Air Force, he was loaned to the new service, being appointed later the same year Deputy Director of Education in the Air Ministry.

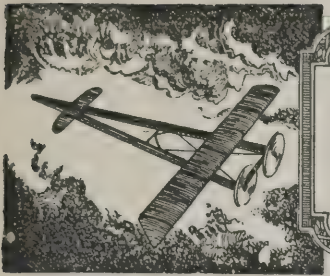
Capt. B. H. Sisson, B.A. (Cantab.), was Ash Exhibitioner, Emanuel College, Cambridge, and was successful in the Mathematical Tripos, 1909. He has been Mathematical and Science Master at Haileybury College, and has held various other educational appointments at home and abroad. During the war he served in the Royal Flying Corps (1915-1917), and in the Royal Naval Air Service (1917-1918). In the latter period, as flight-commander, he was balloon officer to the First Battle Cruiser Squadron, serving in H.M.S. *Lion,* and was mentioned in despatches. He has been engaged as a staff officer on educational duties at the Air Ministry during the past year.

Britain Puts Dirigibles on the Market

The Air Ministry has definitely abolished the airship section of the Royal Air Force with full consent of the admiralty. This drastic step at a time when America has bought Britain's greatest airship, the R-38, sister to the R-34, which was recently wrecked, shows the surprising lessons learned by the Air Ministry in the last few months, for it proposes to concentrate in the development of heavier-than-air machines, believing that the dirigible (or Zeppeline type) is obsolete for military purposes. The airship is considered too slow and bulky and vulnerable to attack for future wars, when it would be an easy target as it is now conceived.

All functions formerly performed by airships can be carried out adequately by aeroplanes, which now can climb higher, fly faster and have a greater flight range. They are equipped with non-recoil guns and can carry bombs as heavy as a ton in weight.

The latest development in aircraft here which probably has done much to bring about the ministry's decision is known as the Amphibian type. This machine is capable of taking off from a land aerodrome and coming down in the water, from which it can take off again in a remarkably short distance and return to land. The machine surprised the neighborhood of Whitehall this week by gracefully landing in the Thames opposite the Parliament buildings. After landing the machine again took the air in a heavy fog and from between two bridges not more than a quarter of a mile apart. Such a machine, capable of landing in a small space either on water or on land, would be a much more formidable craft in wartime than any airship ever conceived.



ELEMENTARY AERONAUTICS *and* MODEL NOTES

The Classification of Model Aeroplane Types

MODEL aeroplanes may be grouped in definite classes according to the particular features of their design, structure and purpose. In this notation of the various forms a model aeroplane may take, we will deal only with that form of heavier-than-air craft which derives its lift from planes or wings moved through the air. This does not include the ornithopter and helicopter types of heavier-than-air craft; the former relies upon flapping wings for flight (although this principle is the very earliest and the least successful it is by no means to be discarded as impossible) and the latter is supported by means of lifting screws or propellers. The helicopter has recently shown more promise of success in full scale tests and may yet prove its worth, but for purposes of elementary experiments with models, the more familiar types are likely to continue in favor.

In order to acquire the widest possible knowledge and enjoyment of models, builders should experiment with many different types in order to observe the various characteristics peculiar to each. There are, to begin with, two distinct types: non-flying models and flying models.

Non-Flying Models

The non-flying models include scale reproductions of large aeroplanes and models built to test or demonstrate some physical or aerodynamical features applicable to full scale aeroplanes.

Scale Models

Scale models for ornamental purposes are often made to have only the external appearance of the aeroplane it represents. Most of the delicate detail is usually omitted because of the expense and great care required for its reproduction at small scale, but in good models, each part is finished to the outside appearance of the full sized aeroplane. For this class of model the entire machine may be built solid, of wood. Balsa wood is an ideal material for this purpose, but better finish is obtainable when white pine or even harder wood is used.

Another type of scale model is one in which the internal structure is made to scale. This is the most difficult type to build although one of the most valuable to those with an appreciation of real aeroplane detail. Students acquire considerable knowledge from having built a real miniature of some large successful aeroplane, and although the very small fittings and parts cannot be reproduced with absolute accuracy, enough general detail may be retained to make the effort worth while. The true scale model should have control surfaces workable—ailerons, rudder and elevators.

Wind Tunnel Methods

Models tested in wind-tunnels are built to the outside contour of the real aeroplane of which they are scale reproductions. Accuracy is paramount in wind-tunnel models, for the slightest variation from true dimensions would render the wind tunnel test results worthless. For this reason, these models are made accurate to within 1/5000 of an inch. In contour alone does the wind-tunnel model resemble the large aeroplane, for the materials used are chosen with reference to their special purpose and regardless of their appearance; for example, the body is usually of hard close-grained wood, which must be finished off absolutely smooth. Struts and other parts which create resistance are all carefully located. Wires are omitted, for their resistances are usually determinable from tabulated data. Tail works are of hard-wood or metal, the latter being preferable.

The wings are the most important part of a wind-tunnel model and the selection of a suitable material for their formation has caused a great deal of perplexity. Wood will not retain its shape; hard rubber warps; fibre does not hold its shape well; steel and brass are difficult to work and are apt to spring at the thin trailing edge. One of the best materials thus far employed is "duralumin," a metal alloy composed chiefly of aluminum. Struts and tail surfaces are sometimes made of this composition which is first cast in a rough mould and then machined to shape. The actual cost of labor and materials to build an accurate scale model of the modern aeroplane is from one thousand dollars to fifteen thousand dollars.

Flying Models

Under the heading of flying models we can group the scientific model and the flying scale model. The scientific model may be classed as that which is built to be flown with the most efficient utilization of its motive power and sustaining surfaces. The nature of our motive power determines, to a large extent, the form of the model body. The simple glider, for example, needs only a structure to maintain the correct relation between the supporting surface and the stabilizing surface.

Power Plants

Rubber strands are the most popular source of power for a flying model. The power derived from twisted rubber strands is sufficient for ordinary purposes when considered from the standpoint of economy and reliability. Other power plants that have proven successful, but entailing some expense and necessitating careful handling, are compressed air motors, steam engines (flash boilers) and gasoline internal combustion engines; these types are usually heavy and are employed chiefly in the larger types of models.

Whereas rubber strands constitute a complete power unit in themselves, the other forms of power plant require accessories that are not as conveniently compact. The compressed air motor requires a tank carrying a sufficient volume of air. The steam boiler must carry water, which is heavy and which, as it is used, would cause a disturbance in the equilibrium of the model if not given consideration. The consumption of gasoline in an internal combustion engine causes the weight (and often the balance) of the model to vary as the flight progresses. Then, too, there is the head resistance which assumes great importance at high speed. On this account it is better for amateur builders to master the various rubber-driven types before attempting to build engine-driven models.

No matter what form of power plant is selected for the model, the number of propellers and the number of power plants carried may vary. The simplest installation is the single power plant and direct driven propeller. With a single power plant it is possible to drive two propellers by means of suitable gearing which may reduce or increase the number of propeller revolutions as desired.

When twin propellers are used, it is possible to arrange them to rotate opposite to one another and thereby neutralize the torque or twisting tendency present whenever single propellers are used. This is the principal reason that most flying models are provided with twin propellers, one turning in "clockwise" direction and the other "anti-clockwise."

Sometimes more than two propellers or more than one power plant is used, although for the most efficient results two propellers and two power plants have been found to be best for models. In full-scale aeroplanes, especially long-range commercial or passenger transports, multi-engine installations are necessary as a precaution against engine failure at critical times which might cause disaster, but as this emergency does not exist in model work, the use of more than two power plants is rarely justifiable.

Scale Flying Models

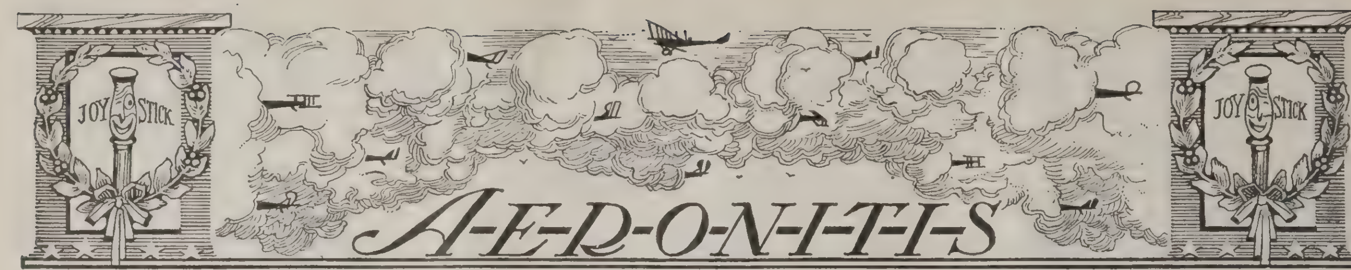
Reproductions of real aeroplanes can be made to fly if certain departures are made in the structure to accommodate the rubber elastic power plant and the model made light and balanced correctly. The control surfaces can be made movable as on the large aeroplanes, but better flying results are obtained if the surfaces are made continuous with the surfaces to which they are adjacent. Scale flying models may be made to fly from 100 to 500 feet.

Scientific Models

Sometimes scientific models are called "flying sticks" because of the prominent sticks needed to hold the rubber strand motive power. They usually bear no great resemblance to a real aeroplane, except for the appearance of the wings, but they employ the identical principle of lift reaction that makes the real aeroplane possible.

As scientific models are subject to the same laws of "lift and drift" as a real aeroplane, wing-forms and arrangements can be employed with as great a variation as found in full-sized aeroplanes. In form, wings may have flat span, dihedral, sweep-back, taper, etc.

(To be concluded next week)



Where Our Aviators Come From

Time: 1918.

Place: Recruiting Office.

Scene I: Recruiting office. Room contains two desks and chairs. Various signs on wall—"Join the Navy," "See—Save—Serve," "See the World." Chief yoeman seated at desk, yoeman seated nearby busily pounding typewriter with two fingers.

(Enter Lawson, with shovel on shoulder.)

"Hello, Mister. I want to join the Navy."

Recruiting Officer: "You want to be an aviator?"

Lawson: "Yes."

Recruiting Officer: "Good! We need strong aviators like you in San Diego, where there is lots of sand. (Glancing at shovel) I see you brought your aviators' tools right with you."

(Enter Probst, with ragbag on shoulder.)

Recruiting Officer: "You want to enlist?"

Probst: "I want to be an aviator and see the world."

Recruiting Officer: "What education did you have?"

Probst: "I went through college with the janitor one day, sir."

Recruiting Officer: "Good! We will make a chief machinist's mate (H) out of you."

(Enter Cloud): "I haven't had anything to eat for five days and I'd like to enlist."

Recruiting Officer: "What did you do before?"

Cloud: "I was following the ponies."

Recruiting Officer: "Good! We need men for shovel hands; we'll make you a quartermaster."

(Enter Miller): "Oh, Mr. Recruiting Officer! I want to be an aviator and be among the men."

Recruiting Officer: "Well, we can make you a chambermaid on a blimp."

Recruiting Officer: "Who left that red light burning by the doorway?"

Yoeman: "That's no red light; it's a recruit named Spencer."

Recruiting Officer: "Ask him if he knows anything about carpenter work."

Yoeman: "He said, 'No'."

Recruiting Officer: "Send him to the lighter-than-air carpenter shop in San Diego."

(Enter McCaig.)

Recruiting Officer: "Why do you want to enlist?"

McCaig: "The cops won't let me sleep in Scully Square no more."

Recruiting Officer: "What's your trade?"

McCaig: "Acrobat."

Recruiting Officer: "What kind of acrobat?"

McCaig: "Porch-climber."

Recruiting Officer: "I guess we will put you on rigging work on the B-18."

(Exit Draft for San Diego.)

Naval Air Current, San Diego.

Famous Last Words

"I wonder if it's loaded. I'll look down the barrel and see."

"Oh, listen! That's the train whistle. Step on the accelerator, and we'll try to get across before it comes."

"They say these things can't possibly explode, no matter how much you throw them around."

"I wonder whether this rope will hold my weight."

"It's no fun swimming round in here. I'm going out beyond the life-lines."

"Which one of these is the third rail, anyway?"

"There's only one way to manage a mule. Walk right up behind him and chastise him."

"That firecracker must have gone out. I'll light it again."

"Watch me skate out past the 'danger sign. I bet I can touch it."

Southern Underwriter.

Pop McCoy—What makes you think you want to get into the Naval aviation?

It—Why, fawthaw said I was of no use on earth.

Ben—Yes, I was in the Army.

Monte—What did you do in the Army?

Ben—I was a pilot.

Monte—What! an aviator?

Ben—No, I was in the Cavalry.

Monte—What do you mean, pilot in the Cavalry?

Ben—Every morning the top would hunt me up and tell me to pile it here and pile it there.

In the lobby of the St. Francis Hotel a young lady stepped up to a lonesome rookie who was doing some sightseeing and inquired: "Are you looking for a particular person?"

"I'm satisfied," he said, "if you are."

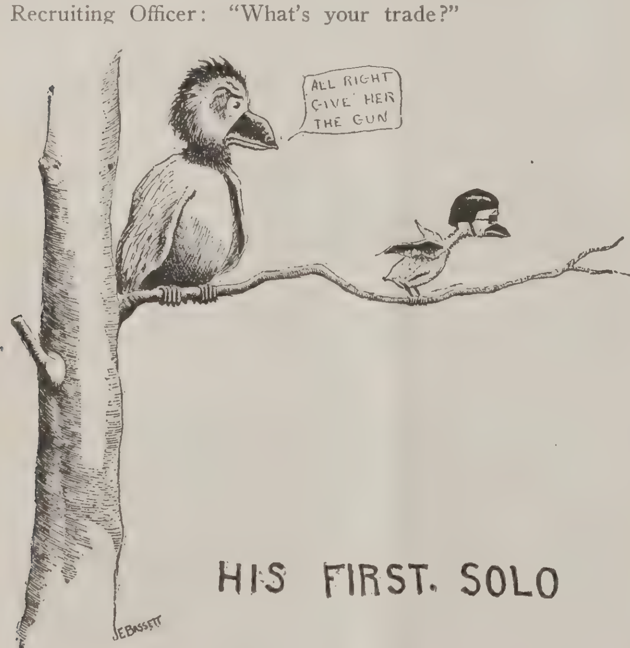
Into the Dawn

Out of the night he flies,
Into the dawn.
For him the starry skies,
Far distant suns arise,
For him the morn.
Stars crowd his shining Plane,
Crowd and then fade again,
Dim and die out again,
Into the dawn.

Out of the night he soars,
Into the dawn.
Out of the murk he draws
Victor of nature's laws,
Challenging scorn.
Winging, his Plane a-gleam,
Soaring through ways a-gleam,
Pierced by sun's rays a-gleam,
Into the dawn.

Out of the night he flew,
Into the dawn,
Into the gath'ring blue,
Upward and on and through,
Streaming with morn,
Flying on beams of light,
Flooded in pools of light,
Shining in seas of light,
Into the dawn.

Harold A. Danne.



Engineering

AERIAL AGE WEEKLY

)L. 13, No. 6 | APRIL 18, 1921 | 10 CENTS A COPY

"Bellarso," Residence of Mr. Frank N. Hoffstott, Sands Point, Long Island, Photographed by Capt. James Suydam

President Harding on Aeronautics

LISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
riptions: Domestic, $4; Foreign, $6. Entered as second-class matter March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

LESLIE V. SPENCER, M.E.
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of
Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIII — NEW YORK, APRIL 18, 1921 — NO. 6

Foreign Aeronautic Business

THE news that Japan has placed substantial orders for aeroplanes and engines with British and French manufacturers demonstrates that tremendous markets are to be obtained by the firms and countries able and willing to make a sufficient bid for them. We have recently conferred with an important official of the group who negotiated the transactions and were informed that only one American manufacturer put in a serious bid on this business. America, from the standpoint of resources, ability, and industrial activities, is in a better position than any other country to secure a major share of the world's aeronautic business, and an aggressive and constructive effort should be made to familiarize all governments, and organizations, interested in aeronautic equipment, with the fact that we can take care of their orders to the best advantage.

The Utility of the Parachute

THE recent parachute tests carried through by the Army Air Service, and especially where as many as five men have jumped from one machine, have given ample testimony of the utility of the parachute. Public opinion is being educated to the fact that it is an efficient safety device, and the tests are merely a forerunner of the time when every passenger-carrying machine will be so equipped. Popular misconceptions regarding the use of parachutes are gradually being removed. The real use for the parachute is as an aerial life-buoy. Every ocean-going vessel has its collection of life-belts and sea-buoys. They are not to make the passenger think that an ocean voyage is dangerous, but are ready for use in case of an emergency. One of the arguments often quoted for not fitting parachutes to civil aircraft is that the mere sight of them would cause passengers to think that flying was unsafe. This misconception is slowly being removed. For an amateur the taking off will undoubtedly be unpleasant, but it is as desirable as dropping from the deck of a sinking vessel into ice-cold water at dead of night.

Aerofoil Development

TESTS on wing sections still form a considerable portion of wind channel work in Great Britain. An advance in the design of aeroplane wings has lately been made possible by the introduction of a new feature which renders possible the conversion of a high speed low lift wing into a high lift wing. The experiments on this invention are still of a preliminary nature, but sufficient data are available to show that the speed range of aeroplanes in the near future will be very greatly increased.

Experiment has continued on a number of wing sections of the fixed camber type. The Fokker thick aerofoil section has been tested and gave a maximum lift coefficient of 0.765 compared with 0.845 for the R.A.F.19 section, and similar values for some of the American high-lift wings, such as U.S.A.T.S.5. Two Bristol aerofoils with characteristics similar to the section R.A.F.15, together with modifications of the last-named have been tested, but they provide no new developments; similar remarks apply to the biplane test of R.A.F.19, with maximum lift coefficient of 0.797. In considering these and other sections, attention may, however, be drawn to a method of comparing the relative merits of various aerofoil sections based on the principle of plotting horse-power necessary against forward speed.

Of greater interest is the result of an investigation on the performance of a wing of variable camber. The form of the section is variable by means of a narrow front flap and a fairly wide rear flap, both being moved simultaneously so that the new chord is always parallel to the original. A strut shaped section was taken and the resulting aerofoil was as good as R.A.F.15. Similar experiments on a better primary, such as R.A.F.15, promise a greatly increased performance: these are now in hand. The form of cambered wing here tested had not the disadvantage of a large change in the position of the center of pressure such as is usually associated with the introduction of flaps on the wings.

Two other experiments on wing sections are worthy of mention. At East London College the flow in the rear of a triplane at small angles of incidence has been carefully explored over a depth of three or four chords and a distance behind the model of five chords. The downwash was found to be more persistent than is the case with a monoplane and to be fairly evenly distributed across the field between the top and bottom planes. For purposes of computation the monoplane results for a different section may be employed without great error, and the triplane interference defined by the decrease in the effective lift.

The other experiment related to the roughening of the surface of an aerofoil. A roughening of the under surface with fine sand produced little effect and with coarse sand a great decrease in efficiency. A roughening of the upper surface with fine sand near the region where the tangent to the surface is horizontal gave a small percentage increase in the lift/drag ratio over the whole flying range.

In connection with controls, a useful and extensive series of aileron tests has been completed at the N.P.L., where the effect of a variation in aileron chord and span, in washout and in taper, was examined. The "Panther" type of aileron was found to be more efficient than the S.E.5 type and to compare well with that of the B.E.2C aeroplane. In other tests on balancing, the position of the hinge for complete balance, the variation of balance with incidence, the effect of yaw and gap, and the desirability of making the ailerons of full-wing section were all tested. The information gained from these experiments should be ample for the design of ailerons with any desired amount of balance.

THE NEWS OF THE WEEK

Harding Orders Code of Air Rules Drafted

Washington.—Looking toward greater use of the air by military and commercial aeroplanes, President Harding has directed the National Advisory Committee of Aeronautics to name a special committee to investigate and formulate "rules of the air," which later may be made the basis for legislation providing a Federal code of aviation.

Charles D. Walcott, chairman of the committee, advised the President that a committee consisting of representatives of the Army, Navy, Postoffice and Commerce departments and commercial aviation interests had been tentatively selected and would begin to function within a short time.

The committee selected by Dr. Walcott is to take up all angles of aviation, including a comprehensive scheme of landing fields for government and commercial planes; the mapping of definite air routes; provisions for the maximum and minimum loads for planes of the various types; suggested plans for the licensing of aviators, not included in the army and navy air services, and regulations for interstate flying.

Out of the recommendations of the committee, it is believed, will come a definite program for controlling all flying in the United States.

Aviators' Ball Great Success

The third annual Aviators' Ball was held at the Waldorf-Astoria, April 7, and was largely attended. Incidental to the ball, Brig.-Gen. William Mitchell flew from Bolling Field, Washington, D. C., bringing several guests. They arrived in plenty of time to attend the dinner arranged for them, preceding the ball.

The newly appointed Ambassador to France, Myron T. Herrick, had as his guests the former Premier of France, Rene Viviani, and the French Ambassador, Jules J. Jusserand; also Gaston Liebert, the French Consul General, all of them coming from the dinner given by the American Committee for Devastated France at Delmonico's.

Brig.-Gen. Douglas MacArthur, Maj.-Gen. Charles T. Menoher, General du Pont, Jefferson De Mont Thompson, Air Commander L. E. O. Charlton and Rear Admiral Harry P. Huse were among the other guests of the evening.

Among those who entertained at dinner, bringing their guests afterward to the ball, were Mrs. Arthur Woods, Mrs. William Taylor, Miss Anne Morgan, Mrs. Newbold Le Roy Edgar, Mrs. Charles Addison Miller and Mrs. Francis Burrall Hoffman. Mrs. Hoffman's dinner was for General Mitchell, and among her dinner guests were Mrs. Vanderbilt, Professor and Mrs. Fairfield Osborn, Mrs. Charles Van Rensselaer, Miss Josephine Osborn, Miss Muriel Vanderbilt and Mr. and Mrs. Gordon Knox Bell.

The members of both the Junior and Aviators' Committee wore the aviation brassard, bearing the aviators' wings in silver, as a badge of their office. Mrs. Newbold Le Roy Edgar was head of the Patroness Committee, and Dr. E. Garnsey Brownell was Chairman of the ball. Mrs. Lewis Gouverneur Morris and Miss Symphorosa Bristed were at the head of the Junior Committee.

Besides the general dancing, which took up most of the second floor on the Astoria side of the hotel, there was a program of entertainment by professionals who donated their services. The affair was sponsored by the Aero Club of America, and many of the aces and prominent aviators attended.

James Blackstone Taylor, Jr., for the navy, Albert P. Loening, for the army, and J. Kendrick Noble, for the Marine Corps, were at the head of the aviators' committee, which also included Captain Eddie Rickenbacker, Major A. J. Christy, Major Henry F. L. Miller, Major Henry L. Watson, Glenn L. Martin, Captain Harold E. Hartney, Schuyler Schieffelin, Elliott Springs, Thomas E. P. Rice, Maurice Cleary, Elliot Cowdin and Charles E. Merrill.

Mrs. George J. Gould, Mrs. Harry H. Flagler, Mrs. Edward F. Harkness, Mrs. Richard T. Wilson, Mrs. James Blackstone Taylor, Jr., Mrs. James B. Haggin and Mrs. E. N. Breitung were among the boxholders.

Aeroplane Luncheon

Mr. and Mrs. Leslie C. Brand, of Glendale, California, celebrated April 1st in rather a unique fashion. They issued invitations to local aeronautic enthusiasts requesting their presence at an aeroplane luncheon to be held at their private clubhouse and attendance was requested by aeroplane only.

The L. C. Brand aerodrome is located along the foothills between Glendale and Burbank, about five miles north of the Mercury and Rogers fields of Hollywood. It is beautifully situated, and undoubtedly many of the local airmen took advantage of the unique invitation.

Aerial Strap-Hanging

London.—London has long known the strap-hanger in subway, street car and omnibus, but only recently the first instance of aerial strap-hanging was recorded. On the second day of the resumed British air service to Paris it was found that one of the departing machines had no seats for three of its passengers.

They made the journey standing in the passageway holding on to the luggage racks.

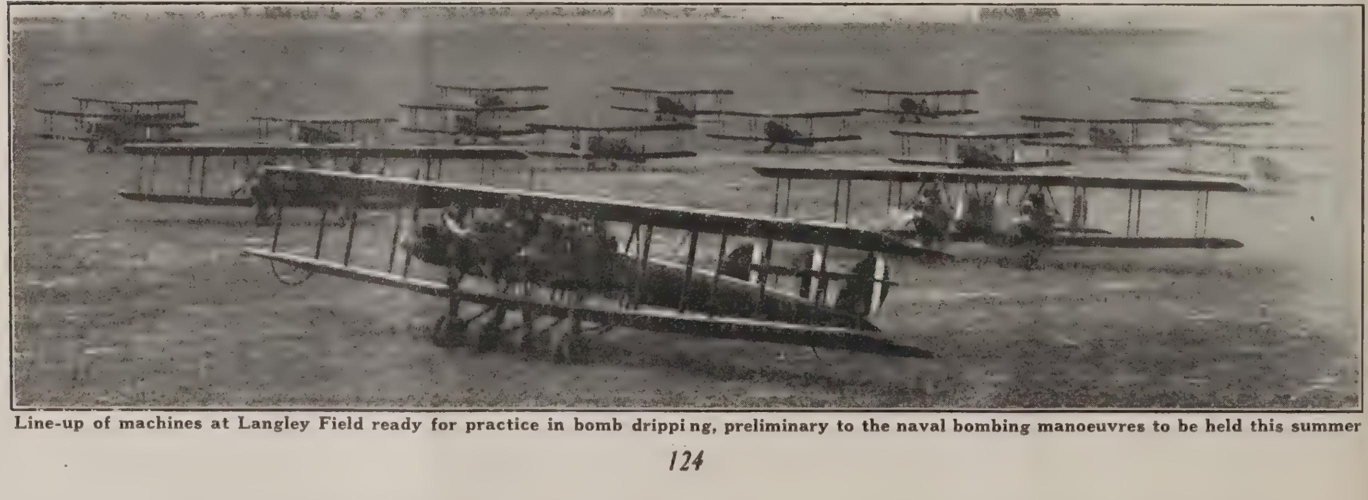
Facts Concerning Flight to Ft. Norman, MacKenzie District

Concerning reports of an expedition by aeroplane from Edmonton, Alberta, to Ft. Norman, MacKenzie District, said to have been undertaken by the Imperial Oil Company, the following has been received by the Chief of Air Service from the Air Board of Canada, under date of March 14:

"As far as this Department is aware, the report that two machines operated by the Imperial Oil Company of Edmonton, Alberta, have successfully flown to Ft. Norman, is erroneous, although it is understood that they have recently left Edmonton for the North Country.

"The information which we have at present is that these two machines, after being outfitted at Edmonton, flew to Peace River, a distance of approximately 250 miles, in a little over three hours. After some delay at Peace River it is understood that they have now set out on their next stage, the objective of which we understand was to be in the neighborhood of Hay River and Windy Point, on the western shores of the Great Slave Lake, a distance from Peace River of approximately 375 miles. Beyond Peace River there is no communication available either by wireless or telegraph line, hence information regarding the progress of these machines is likely to be slow and interrupted in transmission. It is understood, however, that the expedition has made arrangements to send back reports of their progress by relays of pigeons.

"So far as the probability of a rapid trip as far north as Ft. Norman is concerned, it is hardly to be considered as likely that such a trip will be undertaken, as it is understood that the Imperial Oil Company had in mind the establishing of



Line-up of machines at Langley Field ready for practice in bomb dripping, preliminary to the naval bombing manoeuvres to be held this summer

a fairly well-equipped base on the western shore of Great Slave Lake (which would necessitate several trips back and forth from Peace River in order to bring personnel, supplies, etc., for drilling operations) before endeavoring to push on further in the direction of Ft. Norman."

Airships May Carry Food in British Strikes

London, April 8.—The Air Service is likely to be used for transportation of food by the Government in case of a strike by the Triple Alliance. In recent conferences held by the Government departments for the discussion of the best means of safeguarding the food supplies of the public in the event of such a strike the representatives of the Air Ministry have taken an important part.

Plans have been considered for the use of airships and aeroplanes for this purpose. At least four big airships would be available for the carriage of foodstuffs from the ports to the large inland industrial areas. Heavy aeroplanes could also be utilized for the same purpose, while lighter machines would probably be employed as mail carriers.

Knauss With Stout Engineering

Stanley E. Knauss, who has been closely connected with the sale of commercial aircraft since the war, and who for the last two years has been sales and advertising manager for the Continental Aircraft, Incorporated, has been made sales manager of the Stout Engineering Laboratories, Inc., Detroit, and will assume his new duties immediately.

Production on the new Stout commercial aeroplanes will begin very shortly in the Detroit plant. It will be remembered that the Stout commercial ship was thoroughly tested last fall and the performance was far greater than had been anticipated.

Further announcement regarding prices, carrying capacity and delivery dates will be made in the near future.

Aerial Enthusiast at 102

After her ninth aerial trip the other day Mrs. Ann Sissons of Mansfield, England, 102 years old, went out and got herself baptized and confirmed by the Bishop of Sheffield at Pitmoor. She made her first flight after her hundredth birthday and says she loves the game and is going to play it the rest of her life.

"Why not?" she said. "I started my second hundred in better condition than I started my first, for I could walk at the beginning of my second hundred, so I thought I might as well learn to fly as I had learned to walk."

Airliner Engineering Co. Organized

The company which has been doing business at Amityville, Long Island, under the name of L. Charles Cox, has recently been incorporated under the name of the Airliner Engineering Company. The officers of the company are as follows: George C. T. Remington, President and General Manager; L. Charles Cox, Vice-President and Treasurer; Vincent J. Burnelli, Chief Engineer and Designer; William Sullivan, Assistant Engineer, and John Carissi, Construction Supervisor.

The plane is of the large type, built to carry twenty-five passengers. It is of the thick wing type and the fuselage is built to accommodate two Liberty engines. In addition to this the fuselage has the necessary contours of a wing which makes it self-lifting. This idea is Mr. Burnelli's and the patent has been applied for.

The official wind tunnel tests, conducted at the Curtiss plant, Garden City, were very successful.

Aeroplanes for the Army

The following awards have been made by the War Department for furnishing pursuit and bombing aeroplanes:

Boeing Co., Seattle, Wash., approximately $1,400,000 for 200 Thomas Morse type pursuit aeroplanes.

L. W. F. Co., Garden City, L. I., N. Y., 35 Martin bombers, $23,000 each.

President Harding and Aeronautics

IN his address to the Sixty-seventh Congress, convened in extraordinary session April 12, President Harding made the following references to our present aeronautic situation:

Aviation is inseparable from either the army or the navy, and the Government must, in the interests of national defense, encourage its development for military and civil purposes.

The encouragement of the civil development of aeronautics is especially desirable as relieving the Government largely of the expense of development, and of maintenance of an industry, now almost entirely borne by the Government through appropriations for the military, naval and postal air services. The air mail service is an important initial step in the direction of commercial aviation.

It has become a pressing duty of the Federal Government to provide for the regulation of air navigation; otherwise independent and conflicting legislation will be enacted by the various States which will hamper the development of aviation. The National Advisory Committee for Aeronautics, in a special report on this subject has recommended the establishment of a Bureau of Aeronautics in the Department of Commerce for the Federal regulation of air navigation, which recommendation ought to have legislative approval.

I recommend the enactment of legislation establishing a Bureau of Aeronautics in the Navy Department to centralize the control of naval activities in aeronautics, and removing the restrictions on the personnel detailed to aviation in the Navy.

The Army Air Service should be continued as a coordinate combatant branch of the army, and its existing organization utilized in cooperation with other agencies of the Government in the establishment of national transcontinental airways and in cooperation with the States in the establishment of local airdromes and landing fields.

Lynnway Aerial Transportation Co. Organized

The Lynnway Aerial Transportation Co., which was formed in Lynn, Mass., is to engage strictly in commercial aviation work.

This new company is practically a subsidiary of the Lynnway Aircraft Co., and it will take over the flying school, aerial advertising, photography and exhibition work which the former company handled, leaving the passenger carrying work from the Lynnway Field for the older firm to manage.

The new firm plans to operate from the Lynnway airport and Providence airport, R. I. 43. Already many contracts have been signed and many more are pending for the season's work.

The organizers of the company include the following, several of whom hold temporary offices in the organization: President, George B. Glendenning of Providence, R. I., who was chief test pilot of the 839th Aero Squadron in France; treasurer and general manager, O. Wellington Snell, 106 Lynnway, Point of Pinés, who was an organizer of the Lynnway Aircraft Company; chief pilot, Lt. Linwood W. Tracy of Boston, an ex-army flying instructor who was connected with the Lynnway Aircraft Company; sales manager and secretary, Fred Fontaine of Boston; technical experimental man, Burpee A. Fancy of Somerville; photographer, Charles Darling of Salem; Ralph M. Haines of Toronto, Canada; Asa G. Kimball of Cliftondale, Walter W. Bouche of Boston and John E. O'Cain of Lynn.

The pilots who are to fly for this company are Lt. Hallock Rowse of Worcester, and Lt. A. R. Brown of Collingwood, Ontario, who was with the Royal Air Forces.

Daredevil Haines, a student of the Locklear school for acrobatics, will do the aerial thrillers. He is noted for his parachute jumping, wing-walking, act of changing planes in mid-air without using a rope ladder and other death-defying stunts.

Washington S. A. E. Meeting

At one of the best-attended meetings of the season, held in the Cosmos Club, Washington, on April 2nd, Brig.-Gen. William Mitchell told members of the Society of Automotive Engineers of the plans being made by the Air Service to test the effectiveness of aircraft attacks on battleships which will be made this summer. In his description he stated that no defense from the ground or water would be efficient against an attack from the air and that only counter-attack from the air could be depended upon. Anti-aircraft fire was used during the war chiefly to protect balloons.

Six thousand feet was given as the best altitude for bombing from the air and present accuracy was stated to be about ten times better than it was in the past war. Three-inch deck armor is the limit of thickness which can be pierced by gravity bombs, but we do not know yet if it is necessary to actually pierce this armor, as the bombs may do sufficient damage otherwise. This is one of the questions which it is planned to settle in the bombing tests this summer. England and France, General Mitchell stated, are now carrying out similar tests.

A striking comparison was made between the total weights of three types of missiles and the weights of the explosives which they contained, shells containing only 2½% of explosive and torpedos 20%, while aircraft bombs contain over 50% of their weight in explosives. The Air Service is planning to attack ships first with gas bombs, then with 300-pound high-explosive bombs, following this with 1,100-pound high-explosive bombs.

The 1,100-pound bombs are expected to have a serious effect on a ship if they drop within 60 feet of it, and the service plans to make tests of this on one of the surrendered German battleships. The General described some recent American developments in aeroplanes and bombs, stating that the United States was making very rapid advances and that all-American equipment of excellent performance had been developed, making this country independent of foreign sources. In concluding he stated, in reply to a question, that the battleship was not yet obsolete but that it might be superseded by aircraft within the next twenty or thirty years.

Major H. W. Harms, Technical Expert of the Air Service, followed and gave a comprehensive technical description of the aircraft and equipment being developed by the Air Service, illustrating his talk with numerous lantern slides. The Service plans, he informed the audience, to develop four general types of aeroplanes, divided into fifteen types of uses, but that it was not planned to release fifteen separate types of standard aeroplanes for service use, an effort being made instead to combine the different requirements in a smaller number of machines with the object of standardizing them. New officers of the Washington Section for the coming administration year were elected and Dr. H. C. Dickinson and Mr. William S. James, both of the Bureau of Standards, were elected to represent Washington at the National Convention of the Automotive Engineers, which will be held at West Baden, Indiana, next May.

To Tax Spruce Corporation

Port Angeles, Wash.—Assessor Oscar Morse will place on the tax rolls of Clallam County the entire holdings of the United States Spruce Production Corporation, and will include back taxes for three years, during which the property has not been taxed.

He will include in the assessed property of the railroad built to aid in getting spruce for airplanes. He bases his action upon the recent rulings of the United States Supreme Court and the Supreme Court of New York that corporations such as the Spruce Corporation were private concerns and subject to burdens as well as benefits.

H. G. B. Alexander in Florida-Cuba Trip

New York.—H. G. B. Alexander, President of the Continental Casualty Company and the Continental Assurance Company, Chicago, recently took a flight from Key West, Florida, to Havana, Cuba, in one of the Aeromarine Flying Cruisers. In an interview with C. F. Redden, President of the Aeromarine Engineering & Sales Company, in the Sevilla Hotel, Havana, he expressed surprise over the development of commercial aviation in this country.

"Upon arriving in Key West in the middle of the afternoon and finding that the steamship did not leave there until about ten o'clock at night and would not arrive in Havana until the next morning, it was suggested that we take one of your flying cruisers to Havana, which we were told made the trip in a little over one hour," said Mr. Alexander.

"We investigated and found that Aeromarine had been making these flights regularly since the first of November, carrying passengers and mail between Key West and Havana. Upon looking over the boats, we were amazed to find that they were, in every sense of the word, palatial flying cruisers.

"After talking to Major Bernard Smith, Manager at Key West, and to the pilots, we were so impressed with their earnestness that we decided to take the trip.

"The charm and fascination of a fast glide through the water, then soaring into the air over the old fort at Key West and out over the glistening waters of the gulf, is an experience too delightful to describe in words. Below us the ships were tossing about on a turbulent sea, while we were flying through the air with hardly any sense of motion whatever. In sixty-five short minutes, the tower on historic Morro Castle loomed into the distance, and a few minutes later we soared over that grim old fortress and glided down on the deep blue waters of Havana Harbor with its old-world quaintness, memories and customs.

"Until your company placed these remarkable cruisers in service, the trip from Key West to Cuba, at the best, represented eight or ten hours of discomfort and only too often seasickness across those turbulent waters of the gulf, and your success in establishing this wonderful aerial service, thereby reducing this tedious, disagreeable trip from ten hours to seventy-five or eighty minutes, has been a wonderful demonstration of the efficiency of your organization and the seaworthiness and airworthiness of your Aeromarine cruisers.

"I am now convinced that the alleged risk in flying, which still exists in the minds of that portion of the public who have never flown, is largely a myth and is due to lack of information as to the wonderful strides which have been made in the construction of airplanes and the scientific instruments for safely controlling them.

"There will be a conference of insurance men in Chicago in April and, at that time, I propose to bring this matter to the attention of the Board, and I think my experience in discovering the charm and the safety of a fast, graceful glide through the cloud lanes of the sky, in one of your big cruisers, will have its influence upon the attitude of insurance companies in connection with commercial aeronautics."

RADIO COMMUNICATION WITH POSTAL AEROPLANES

By J. L. BERNARD and L. E. WHITTEMORE

(*Continued from page* 106)

4. Methods of Aeroplane Direction Finding

There are a number of methods which have been used for direction finding on aeroplanes. One of these, the "Robinson method" utilizes two coils perpendicular to each other. These are frequently fixed in position on the plane, one fore and aft, the other at right angles to it. A switch is provided for reversing the connection of the latter and the pilot turns his plane to such a direction that the signals are not changed in intensity by reversing this cross coil. Since the signals are of approximately the same intensity as the maximum which could be obtained by the use of the fore and aft coil alone, this method is sometimes called the "balanced maximum method." This method could also be followed employing two perpendicular coils rotatable together.

The British have also used a method sometimes referred to as the "radiogoniometer method" in which each of two fixed perpendicular coils is connected in series with a condenser and a primary coil of a radio-frequency coupler. Both of these circuits are tuned to the wave to be received. The secondary circuit is connected to an "exploring coil" which can be rotated in the field of the two primary coils, the direction of the transmitting station being determined by the position of the exploring coil which gives the minimum signal.

A single rotatable coil can be mounted in the fuselage and the direction determined by the position of the coil which gives the minimum signal. In such a case the transmitting station is on a line at right angles to the plane of the coil. This method is useful when the aeroplane is near enough to the transmitting station to receive loud signals. At greater distances, however, the angle through which the signal cannot be heard becomes so great and the angle through which the signal is loud becomes so small that it is more satisfactory to determine the direction by turning the coil to receive the maximum signal. In this case, the transmitting station is in the plane of the coil. As will be described below, it is advisable to locate this coil as far from the ship's engines as possible and it is therefore frequently referred to as a "tail coil."

The Air Mail Service chose, of the several methods of direction finding two systems which had proven of practical value in ground observation work, and a description of each type of system, as adapted to aeroplanes of the service, is given below.

Fig. 5

5. Experiments with Robinson Method

The coils used in connection with this system were wound in the wings and along the fuselage inside the fabric. Since the balanced maximum connections were used with this arrangement, it was necessary to employ two sets of fixed windings, one (the cross coils) wound along the leading edge of the upper and lower wings of the plane and connected together by wires strapped along the entering edge of the outer struts. The lead-in wires were taken from the upper portion of the loop and run into the radio compartment, as indicated in Fig. 1. The fore and aft coils were wound in the fabric supports of the fuselage and consisted of three turns on either side of same. The dimensions of each loop were 30′ by 4′. Figure 5 shows the two fuselage coils passing through station 6 of the fuselage.

Very little work was done with this system for the reason that it becomes necessary when taking bearings to swing the ship a considerable distance one way and then another beyond the course, and it was found that pilots considered it very desirable to keep their ship headed on one course as closely as possible, at all times, and especially during bad weather, they refused to stagger the ship or make any flat turns to secure the required settings. Work on this system was abandoned in favor of the revolving coil in the tail of the ship.

6. Experiments with Revolvable Tail Coil

The tail coil used in connection with the development on the twin motored Martin plane, is located at station No. 6, in the fuselage of the ship. (See Fig. 1.) This station has dimensions 56″ x 36″, 56″ deep. The coil is mounted so as to revolve on a shaft set in bearings fixed to longerons. The coil itself measures 40″ on a side, and is composed of 12 turns of No. 22 double cotton covered copper wire, spaced ⅛″ apart. The center of the coil is located 144″ from the center of the radio compartment, in which the transmitting set, amplifier, and batteries are mounted.

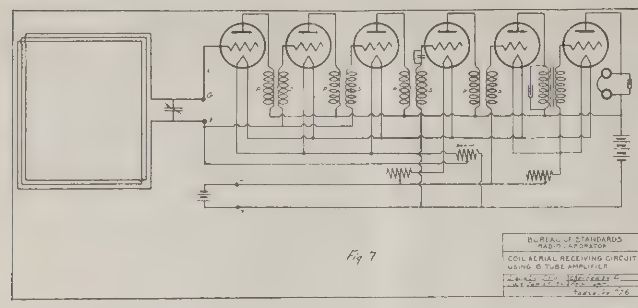
The radio compartment measures 45″ x 36″ x 24″ deep. Attached to the shaft of the radio compass frame is a 10″ scale, calibrated in degrees from zero to 360°. This indicator is 2″ above the turtle back and is readily visible from the compartment in which the operator sits. The coil frame is revolved mechanically by a system of pulleys over which a controlling wire is run, and anchored to both drums of the tail coil and controlling wheel in the radio compartment. A portion of the wires for controlling the tail coil is shown in Fig. 5.

7. Type of Amplifier Used in Experiments

The amplifier used on all direction finding work, on the Chicago-Cleveland Division, was furnished by the Navy Department, and is known as type 1605-B. It consists of a set of six Moorhead electron tubes, used in connection with a tuned radio-frequency and audio-frequency circuit. Three of the tubes are used to amplify the high-frequency currents, one as a detector, and two as audio-frequency amplifiers.

The method of supporting this amplifier in a plane is shown in Fig. 6. The set shown in this figure was designed especially for work on the twin-motored aeroplanes, and represents a complete receiving and direction finding unit, the circuit arrangement of which is given in Fig. 7. The amplifier is mounted on rubber supports, and encased in a sound-proof chamber. It is also protected from weather by a water-proof covering over the sound-proof compartment, for it has been noted during the use of these amplifiers in rainy weather that

Fig. 6



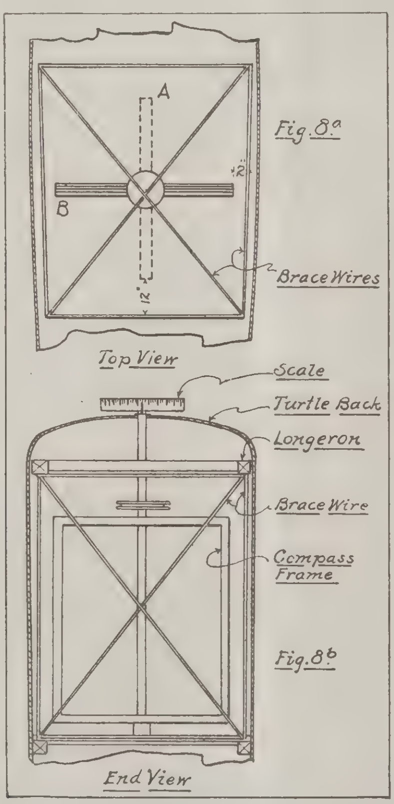
they are very likely to howl due to resistance coupling from one tube to the other when the surface between the grid and plate contact fingers of the tubes becomes covered with moisture.

8. Receiving Apparatus

The panel at the right of Fig. 6 carries the tuning condenser for the tail loop and another for the trailing wire antenna. The latter can be put either in series or in parallel with the antenna loading inductance (located behind the panel) by means of the switch marked "short waves" and "long waves." The amplifier can be connected to either the trailing antenna or the coil aerial by means of the switch in the lower right hand corner. The telephone receivers are the Western Electric Company's type HS-2 and have been found entirely satisfactory even when worn for five or more hours at a time as is normally required of radio operators in the Air Mail Service.

9. Vibration of Tubes

Vibration of tube elements especially in the case of the above-mentioned tubes, creates considerable interference to radio reception, owing to the fact that air vibrations set up by the exhausts and propellers of the Liberty engines are transmitted to the walls of the tubes, thence to the tube elements through the stem. The problem is easily met by mounting



each tube on a separate sound dampening base, and encasing each tube in felt or rubber. Mounting several tubes on a common base, and supporting this base on a rubber cradle, only partially eliminates the difficulty. The use of a sound-proof chamber, as shown in Fig. 6, produces the same result as covering each tube but is less convenient for making adjustments of the amplifier controls. The interference created by the shaking of the elements in the tubes, is not present in the tubes used as radio-frequency amplifiers, the effect taking place only in the last three audio-frequency stages. Here the interference increases rapidly with filament temperatures.

10. Effect of Location of Equipment on Interference

After arranging and moving the amplifier and associated tuning inductances and capacities from one position in the radio compartment to another, it was discovered that there was one location which gave the greatest ratio of signal strength to the engine ignition influences. When the amplifier, particularly, was removed so as to be as far away from any metal fittings as possible, the most satisfactory results were obtained.

Furthermore, the lead wires running from the tail coil into the radio compartment must not be taped to or run near any metal fittings, brace wires, or gasoline tanks. A very appreciable amount of the disturbance picked up from the ignition system is the result of stray fields which appear over the counterpoise acting on the grids of the amplifier tubes and carried to them through the lead wires.

Mounting the amplifier so as to be very close to gasoline tanks or placing a shield over the cabinet containing the tubes and grounding same, tends to increase the disturbance rather than reduce it. Grounding the low potential side of the filament is of no value, but there is, on the contrary, a tendency to make the amplifier howl with certain adjustments. For instance, when flying at a great distance from the transmitting station with the stabilizer of the amplifier so adjusted to give greater sensitivity, it has been noted from time to time that grounding the negative end of the filament invariably causes the amplifier to howl and a new adjustment of the stabilizer and filaments must be made to regain the original sensitivity of the set.

A noticeable change in the sounds produced by the telephone receivers can also be effected by moving the position of any tuning inductances in the radio compartment so as to link with a larger or smaller portion of the magnetic field surrounding the induction coils, lead wires, distributors, etc.

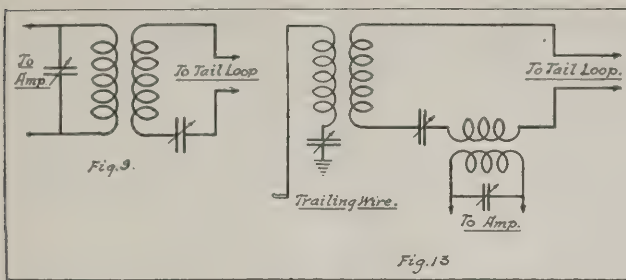
11. Nature of Ignition Interference

After about one hundred hours of study with various types of circuits and arrangements, it was observed that the total electrical interfering influences as indicated by the sounds produced in the telephones, are made up of two distinct groups. It was only after coupled circuits were employed between the tail coil and the amplifier, that this observation was made possible, since a direct coupling between the coil and amplifier resulted in violent sound vibrations, which were of such intensity as to prohibit making any distinction. In certain positions of the tail coil there appeared to be sounds in the nature of strays, having no definite pitch, but producing a crashing and grinding in the telephone; in another position of the tail coil a very clean-cut group of mechanical breaks was noticed. It is believed that the latter group of sounds is probably due to regular very low frequency inductive impulses from the low tension wires, the former to radio-frequency excitation of the coil aerial circuit, owing to oscillating currents in the high-tension ignition wires, spark plug, etc. This distinction appears to be borne out by the results of experiments given below.

When the tail coil is in such a position as to have its plane at right angles to the length of the fuselage, the ignition interference is at a minimum. When revolved 90° to this position, the disturbance is approximately doubled. Therefore, when a long distance is to be covered nearly twice the distance can be covered by radio direction finding when flying at right angles to a line joining the plane and transmitter, as when flying in the line of the transmitting station. This is owing to the fact that when the loop is placed so as to have its plane across the fuselage the engine disturbance is reduced. It was explained above that setting was made on the maximum signal in long distance direction finding.

A possible explanation will be made of the variation of the low tension ignition disturbances when the coil is rotated. The bracing, flying wires, metal fittings, etc., are placed within the stray fields surrounding both the high tension and low tension sides of ignition system, and a current is induced in all such parts. It is evident that there is established about the counterpoise construction as a whole and each separate wire, an electromagnetic and electrostatic field. The intensity of the field about any portion of the counterpoise appears to be of the same strength as observed while making the following test: A sensitive amplifier with its storage battery, plate battery and telephone receivers was mounted on a portable stand. A 5-foot length of insulated copper wire was connected to the grid of the first tube of the amplifier which wire was placed, or in fact, wound directly over various metal parts of the ship while the engines were turning up at normal speed. Indications in the telephone receivers showed that the voltage impressed on the grid of the first tube was of the same magnitude no matter where the exploring wire was fastened.

Figure 8 shows the relative positions of the tail coil and the two Liberty engines of the Martin mail planes. When in



the position shown at "A" in this figure, the coil tends to pick up the greatest amount of high-frequency interference from ignition systems and when in this position the sounds observed seem to be rather mushy or grinding characteristics described above. When the coil is revolved so as to be in position "B", the nature of the sounds is completely changed and they have a rather definite click, are sharp and correspond to regular mechanical breaks.

When in position "B" the coil is affected by the stray fields surrounding the counterpoise construction on the sides of the fuselage, for it will be noted that a distance of but 2 inches separates the coil wires and the fuselage bracing. The interference here noted is similar to that observed when the amplifier is placed near a gasoline tank or other metallic structure. On the other hand, the nature of the sounds as indicated in the telephone receivers in position "A" may be described as having no definite pitch but produce a crashing and grinding in phones and is no doubt the result of radiation from the high-tension system of the ignition arrangement wherein currents of an oscillatory nature are present. The high-frequency ignition systems of the two engines may be considered as two sources of radio-frequency interference. When the receiving coil is in position A, its position relative to the engines is such that the interference produced by the two are additive. In the position B, the relative positions are such that the engines would produce interference in opposite directions in the coil, and therefore the net result may be less (even though these two components are not always exactly opposite to one another in phase).

The result of rotating the coil from position A to position B is therefore to decrease this high-frequency interference (the grinding noises) greatly, and increase the low-frequency interference (the rattle) somewhat. Observations have shown that the effective reduction of interference is about one-half.

12. Shielding the Receiving Coil

Wire screening was placed over the entire station of the fuselage wherein the tail coil was located with a view to reducing the passage of any electrical or magnetic fields within the cage and acting on coil wires. The results were that absolutely no advantage was secured, but the same effect of change of interfering noises when the tail coil was revolved was observed. The next step then was to place a shield directly over the coil wires, but the only advantage in this particular arrangement was the fact that although there was about a ten per cent reduction in the telephone sounds, the interfering influences did not vary with the position of the coil and therefore more accurate bearings could be taken. With this arrangement it is then possible to have but one component of the total electrical disturbance change when the bearings on various transmitting stations are under way, and it has been found that if the interference can be made constant the resulting observations made with the tail loop are much more satisfactory. By connecting the shield of the coil itself to the counterpoise construction better results were secured than leaving the shield ungrounded. It would appear that this resulted in an increase of the low-frequency ignition interference at the fore and aft position of the coil.

13. Detuning

It has been seen, while experimenting with coupled circuits, between the amplifier and coils using the connections shown in Fig. 9, that when resonance exists between the two circuits the signal ratio is less satisfactory, but when the secondary circuit is slightly detuned from that of the coil the ratio is improved noticeably. The interference falls off more rapidly with detuning than the signal, and it has been found that a detuning of about 3 per cent when operating on 1,050 meters wave length, produces best results.

Possibly this is due to the fact that the main interference in the tail coil is the result of a shock excitation produced by oscillating currents in the high-tension sides of the ignition systems and the resulting currents produced in the coil are very feebly damped; whereas those currents resulting from a wave propagated from the transmitting station have greater damping. Therefore, we should expect for a given angular displacement of the tuning condenser above or below resonance, a greater reduction in the transfer of the power associated with the current having the smaller damping. The power associated with the damped current produced by the spark transmitting station should therefore be transferred with little reduction when the secondary circuit is slightly detuned. This is found to be the case in practice.

14. Balancing Out Interference

The most effective solution to the interference problem is found in balancing out the magnetic influences, which attack the tail coil and set it into oscillation, together with the shielding off of the electric field, as previously shown. No doubt the greatest interference is the result of the large momentary currents, the fields of which are embraced by every portion of the radio equipment, and a method is given herewith which has been employed with great satisfaction and by means of which it is possible in some instances to nearly treble the range of radio direction finding as well as reception from ground stations by eliminating the inductive impulses from the low-tension side of the ignition systems.

A small compensating coil with its leads connected to a variable condenser, has several turns of its circuit coupled inductively with a few turns of the radio receiving coil. The circuit is shown in Fig. 10. The purpose of this arrangement is to pick up power with the compensating coil and introduce it into the radio receiving coil so as to oppose and cancel out currents due to shock excitation of the coil aerial. Numerous arrangements were investigated but the most satisfactory results were obtained by doing all the balancing in the radio-frequency side of the circuits.

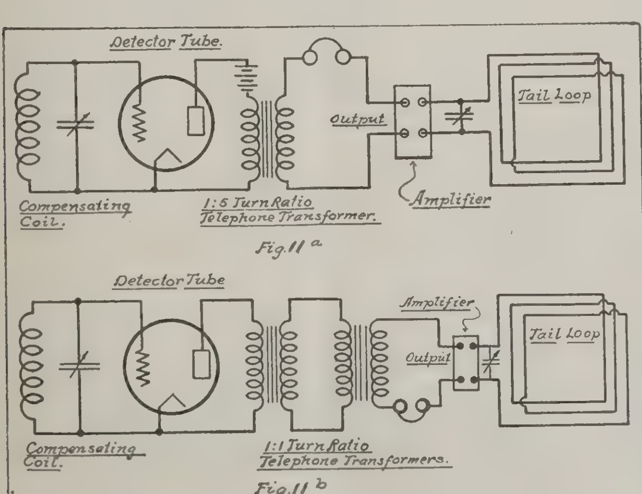
In one experiment an electron tube detector was connected to the compensating coil and the plate circuit of this detector was coupled to the telephone receiver circuit of the radio receiving apparatus, as shown in Fig. 11. While this method was of some value it was less effective in eliminating the interference than the method employing radio-frequency coupling.

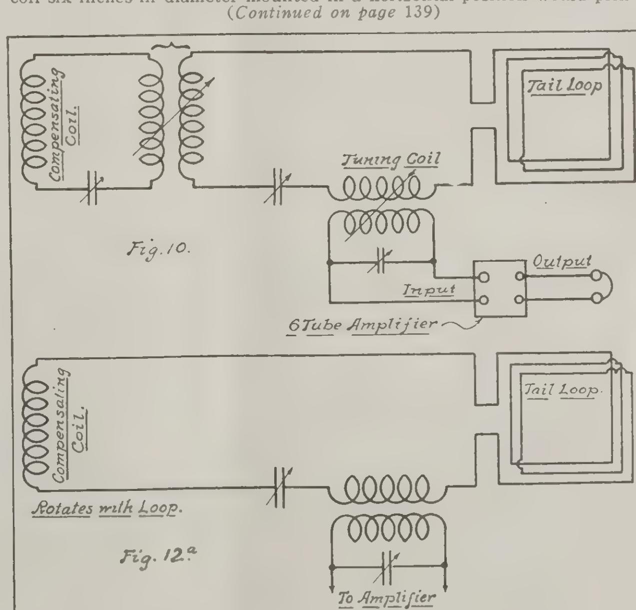
During these experiments the compensating coil was mounted in a fixed position and the coupling between the compensating coil circuit and the radio receiving circuit was changed for different positions of the radio receiving coil, for, as it has been pointed out, the engine disturbance changes in intensity when the receiving coil is revolved.

It seems likely that an equally satisfactory result might be obtained by connecting a small coil directly into the radio coil aerial circuit near the terminal of the tuning condenser, as shown in Fig. 12. The position of this compensating coil with respect to the interfering fields should be made such as to just counterbalance the emf induced in the radio receiving coil by these fields.

Bearings taken on the tail coil when coupled to the exploring coil in such a manner have the same accuracy as when the latter is disconnected, provided the exploring coil, which is mounted in a radio compartment, is small and does not take up any energy from the transmitting station. A coil six inches in diameter mounted in a horizontal position would pick up

(*Continued on page* 139)





REQUIREMENTS FOR ADMISSION TO AIR SERVICE ENGINEERING SCHOOL AT DAYTON

(Concluded from last week)

E. Strength of Materials

This subject is preliminary to work in the Materials Laboratory in considering the physical properties of materials, and analysis of stress. Problems as applied to the airplane are taken up more in detail, as continuous beams, eccentric loading of struts, design of springs and shafts and finally the principle of least work as employed for determining stress in the more complex cases. This is the most important subject for the prospective specialist in engineering.

Reference: Fuller and Johnston, Applied Mechanics, Vol. II.
Morley, Strength of Materials.
Boyd, Strength of Materials.

F. Materials Laboratory

Sufficient work in this subject is taken up so as to enable the student to grasp the problems confronting the designer, the limitations of the various materials going into aircraft, its treatment and how to make samples from failures in the service.

(a) Chemistry

Chemistry of materials is taken up very much as in the text-book by Leighou. Gasoline and lubrication oil is tested according to specifications. A study is made of the anlysis of coal and sundry materials. The chemistry of dopes and storage batteries, the principle of electrolysis and the subject of corrosion and its prevention are also studied.

Reference: Leighou, Chemistry of Materials.
Smith, Inorganic Chemistry.

(b) Metallurgy

Foundry methods and practical processes are analyzed from the scientific viewpoint. Equilibrium diagrams of iron and steel and of non-ferrous alloys are studied. Sample specimens are prepared and examined under the microscope. Problems are given out in the form of microscopic photographs and the student required to estimate composition of the metal.

(c) Physical Testing

Complete tests are run in the testing machines on a large representative lot of ferrous and non-ferrous alloys and a comparative study is made of their strengths, yield points, hardness, etc. Emphasis is laid on the subject of impact and fatigue tests.

(d) Wood

Methods of distinguishing between different kinds of wood as well as grades, are studied from a scientific point of view. Effect of moisture content on strength is taken up among other things and the strengths of glue and in short the limitations of wood through the processes of making it up into complete airplane parts are analyzed thoroughly.

(e) Fabrics

Airplane, balloon and parachute fabrics are studied and tested.

(f) Rubber

This is probably the first course on rubber as applied to the airplane ever run. A systematic study is made of the effect of various ingredients in rubber upon its physical properties. The characteristic behavior of certain rubber is investigated by testing. Under this subject is included a study of airplane tires, wheels, shock absorber cords and so on.

G. Electricity

This course requires a thorough study of the fundamentals or electrical engineering in order to begin to understand the principles involved in airplane electrical problems as well as those of power and lighting at a field. The plan is to give a rapid summary of electricity in its elements by problems and experiments, the instructor assisting. On completion of this, the student is required to undertake several practical problems, unaided.

Reference: Timbie, Elements of Electricity.
Hudson, Engineering Electricity.

(a) Direct Current

Ohm's Law and the fundamentals of direct current electricity, instruments and various generating machinery and motors are anlyzed.

(b) Alternating Current

The fundamental effects of inductance and capacity in series and in parallel in an electrical circuit are studied as well as the application to alternating current machinery. Induction motors, alternators and problems to cause trouble at a station are considered.

(c) Miscellaneous Airplane Electrical Problems

Various electrical equipment, storage batteries, electrically heated clothing, generators, etc., are studied.

(d) Radio

Measurement of wave lengths and the composition of simple radio circuits are studied and the latest radio sets and schemes of communication are investigated. The repair and upkeep of service equipment is touched upon.

Reference: S. C. Pamphlet No. 40.

H. Thermodynamics and Engine Design

From the fundamentals involved in the operation of steam power plants through the various thermodynamic cycles of heat engines, the following sub-topics are considered, keeping always in view the practical goal with either the steam power plant or airplane power plant.

(a) Heat Engineering

A representative number of problems are given out. Only such as will enable the student to understand the work following are used.

Reference: Hirshfeld and Barnard, Heat Power Engineering.

(b) Steam Power Plants

A complete study of the various steam equipment that goes into a complete flying field, including boilers, feed water heaters, pumps, steam engines, steam rollers, etc. Flue gas analysis is made; the type of boiler is studied and the complete efficiency test of a small steam engine is run, including determination of the quality of steam, the electrical output of the engine, indicated horse power and weight of condensate during the test.

(c) Radiators

Such problems encountered in the design of radiators are considered. The method employed here for determining the cause and location of trouble in radiators is taken up in detail. This is emphasized particularly so that such officers as are posted on it would be in a position to make proper recommendations for changes of design in radiators not operating well under service conditions in peculiar climates. A flow test on a typical radiator is included.

(d) Engine Design

The fundamental characteristics of different types of engines are brought out and a complete analysis of the "whys" and "wherefores" of the sundry parts that go to make up a complete engine. The dynamics of rotation of four, six, eight, twelve, etc., cylinder engines are studied. The design of crank shafts, connecting rods, valves, cams, lubrication and water systems integral with the engine are all taken up in detail study. It is intended that the student should complete this with clear enough conception of present-day design that he could very well begin to be in a fair position to judge of new designs, that for example might come in from any locality to his post at a flying field.

Reference: Wallace, Aeroplane Engine Design, etc.

I. Gasoline Engine Laboratory

The student officers are divided into convenient groups and assigned to a standard service engine (Liberty 400 or Hispano 300). The engine assigned to each group must be dismantled, inspected and overhauled for repairs, including grinding of valves and bearings, etc. Then the engine is assembled and put through tests as noted below.

(*a*) The various types of carburetion and complete details of the present-day carburetors are studied. Problems encountered due to various types of gasoline are taken up.

(b) Ignition

Practical phases of ignition systems as applied to present-day engines; both battery generator and magneto types, are taken up thoroughly.

(c) Power Tests

Friction, propeller, full load and fuel runs are made in the Dynamometer Laboratory on the engines assembled. After tests on said engines have been run, the groups of students interchange types of engines and make a complete inspection report followed by a brief analysis of dimensions and weights of the different parts of the engine.

(d) General Engine Data and Repair and Up-keep

A Liberty-12 or a 300 H.P. Hispano-Suiza engine is dismantled by each group of students, examined for overhauling, assembled and timed, and finally run on a test stand. All data on hand along this line is made available to the student officers. Characteristics of each of the engines in the collection had at this Field are taken up.

(e) Accessories and Power Plant Installation Inspection

Airplane power plant accessories consisting of gasoline pumps, valves, hose connections, strainers, etc., are studied and a schematic drawing made of each with the direction of flow and method of operation to be indicated thereon. A Power Plant Installation Inspection is made on a typical airplane and the regulation Engineering Division report similar to the procedure for all new airplanes received.

J. Theoretical Aviation

Under this heading it is intended to include purely aeronautical problems, dipping into the theory only so far as found necessary to give the student an idea of the numerous branches involved and the extent of progress made up to date.

(*a*) *Aerodynamics*

The fundamentals of flight are taken up in their various phases touching upon fluid dynamics with applications to wind tunnel tests and other valuable data. The fundamentals of airplane stability, including the effect of dihedral, sizes of fin, etc., are studied both to show what has been done in the past mathematically or otherwise, as well as to bring out its value in analyzing the behavior of certain types of airplanes.

Reference: Thomson, Applied Aerodynamics.
Wilson, Aeronautics.
Hunsaker, Smithsonian Papers.
Bairstow, Applied Aerodynamics.
Cowley and Levy, Aeronautics.
N. A. C. A. Reports.

(*b*) *Airplane Design*

A rough outline of a simple airplane is to be made in this course and as complete an analysis as possible of the stress of various parts and methods of design thereof is to be carried out. This will include a weight schedule, a fuselage stress analysis and a design of the proper wing and chassis for the airplane under consideration. The purpose of this is to bring out the reasons for the employment of various component parts in the aeroplane structure. The design of one fitting is required. The present design problems of the Air Service will be finally reviewed from the viewpoints of the various designers.

Reference: Pippard and Pritchard, Airplane Structures.
U. S., A. S., Eng. Div., Structural Analysis, etc
N. A. C. A. Reports, Stress Analysis.

(*c*) *Propeller Design*

The rudimentary principles of propeller design, including calculations for a sample propeller and drawing up same is the main problem. Experimental tests of destruction will be explained as will be the reversible pitch propeller.

Reference: A. S. Propeller Manual.

(*d*) *Performance Tests.*

A sample performance test is to be run on an ordinary service machine and a comparison later made of the data obtained with standard tests. Altitude flying, supercharger, etc., also are to come under this head.

(*e*) *Airship Theory*

In as brief form as possible the underlying principles employed in lighter-than-air craft are to be taken up and a brief resumé made of method of design of a simple non-rigid airship. This is to include a rough layout to determine center of buoyancy, distribution of weights and so on.

(*f*) *Meteorology*

A study of the valuable data on hand on this subject is taken up, particularly as affects navigation work. It is intended to determine wind velocities at altitudes by sounding.

Reference: Humphreys, Physics of the Air.

(*g*) *Navigation*

All the valuable methods of navigation are taken up in brief summary, and navigation instruments, including air sextants are employed. Swinging of a ship for corrections is undertaken and a sample cruise made.

(*h*) *Airplane Accessories — Equipment, Photography and Instruments*

Equipment: Types of fire extinguishers, oxygen apparatus, float bags, types of hangars and so on, are taken up under equipment.

Photography: Principles of airplane photography, particularly as brought out in the book by Ives, "Airplane Photography", the types of cameras and mounting now employed and current practice in printing, developing, and so on, are studied.

Airplane Instruments: All types of instruments used on the airplane not purely for the engine or for ignition and lighting —such as tachometers, airspeed meters, turn indicators, statoscopes, rate of climb indicators, etc., are studied and tested.

(*i*) *Camouflage*

A study of valuable information on camouflage for airplanes as well as hangars is considered and a suggested scheme for a service machine required.

End

VICKERS "VIMY" AEROPLANE AMBULANCE

This aeroplane is a Vickers "Vimy" Commercial Type, modified so as to fulfil the duties of "ambulance aeroplane," and is designed to carry the full equipment specified in paragraph 7.

The passengers' or patients' compartment is equipped as specified in paragraph 8.

This aeroplane is constructed in accordance with the published requirements of the Director of Research, British Air Ministry.

All parts other than the fuselage are strictly interchangeable with the service type "Vimy."

Two Napier "Lion" engines of 450 h.p. are installed. The petrol and cooling systems are fitted in accordance with the requirements of modern practice, and provision is made for fitting auxiliary radiators of such size as will make the cooling system suitable for operation in tropical climates.

Load Carried	Lb.
Crew (two)	360
Four patients and stretchers	760
Attendants (two)	360
Wireless equipment	100
Water and tank (medical)	165
Medical equipment	105
Stores	[illegible]
Total [illegible]	[illegible]
Petrol, 16[illegible]	[illegible]
Oil, 14 gallons [illegible]	[illegible]
Reserve water, four gallons	[illegible]
Total load	3,430

N. B.—Instead of four lying-down, or stretcher cases, eight sitting-up cases can be carried, increasing the above load to 4,070 lbs.

The performance with full load, as specified in paragraph 3, and with engine revolutions not exceeding the normal permissible, is as follows:

Speed at 6,500 ft.	109 m.p.h.
Climb to 6,500 ft. (with full load of 4,070 lbs.)	10 min.

The machine will fly with one engine out of action.

Dimensions

Overall length	42 ft. 8 in.
Overall height	15 ft. 3 in.
Span	10 ft. 0 in.
Gap	10 ft. 0 in.
Chord	10 ft. 0 in.
Area of main planes	1,330 sq. ft.

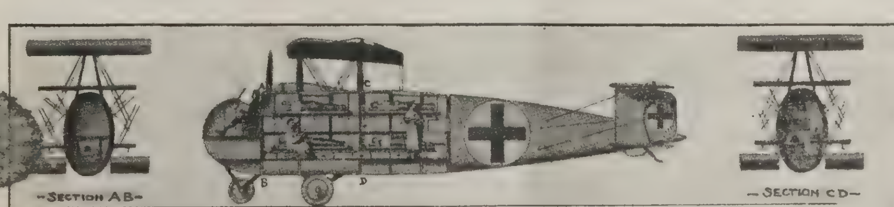
The strength of the main structure is guaranteed not to be less than the following standards when carrying the full load as specified in paragraph 3.

Load factor on front truss with centre of pressure forward	4
Load factor on rear truss with centre of pressure back	4
Factor in nose-diving case	1

In construction the spars are of box section of spruce and three-ply wood bound with fabric; the interplane struts are of hollow spruce, except in the enigne bay, where the struts are of round steel tube, reinforced where necessary, and with wooden fairings; the ribs are of spruce. The engine mounts are carried on four struts each side, and the chassis is attached below the engine mountings, thus minimizing the load in the anti-lift wires.

The fuselage is of Monocoq construction forward, where the passenger accommodation is provided. The shell is of laminated sawn spruce and ply-wood, made watertight to ensure floating if a descent on the sea is necessary, and the large windows and doors in the side are designed to prevent entry of water in the event of this mishap.

The after part of the fuselage is of wood and swaged tie rod construction, the



Sectional illustrations of the Vickers Aeroplane Ambulance

Front view of the Vickers Aeroplane Ambulance

longerons being made under Vickers-Ryan patents.

Throughout the machine streamline steel tie rods are used in external bracing, and round steel rods in all internal bracing; looped wires and ferrules are not used in any important part.

The engine controls are operated by rods and torsion shaft. The main controls are of cable and follow standard practice.

The petrol supply is maintained by fan-driven petrol pumps with regulating valves to maintain a constant flow to a service tank with overflow return to main tanks.

All flying controls are remarkably light in operation, due to the provision of balancing surfaces where necessary.

Provision is made for the following equipment:

(*a*) Wireless equipment—O.W. Transmitter, Type 57. Receiver, model T.f. Earth system.

(*b*) Instruments—The usual instruments of latest pattern are fitted in the pilot's cockpit.

(*c*) The necessary wiring for navigation and recognition lights.

Disposition of Crew, Patients, and Medical Equipment

(*a*) The two pilots are accommodated in the pilot's cockpit in the nose of the aeroplane, side by side, and are provided with full dual control, a wide and unimpaired view of the ground being obtained.

(*b*) Racks for four stretchers of the standard "general service" pattern as used by the British Royal Army Medical Corps are fitted on the side of the cabin opposite to the doors. The stretcher frames are so arranged that there is adequate clearance space between the ends of the cabin and the handles, and also between the handles of each stretcher at the centre.

(*c*) The racks are so arranged that there is sufficient lateral floor space to allow of lifting the stretchers on to the racks without tilting them.

(*d*) The racks can be folded up out of the way when seating accommodation is required.

(*e*) A door is provided in the front of the luggage compartment, under the pilot's seat, allowing of the loading and unloading of the stretchers, thereby effecting a direct and straight entrance to the cabin. Suitable runners are fitted on the floor to facilitate sliding the stretchers into the cabin. It will therefore be appreciated that this method of handling the patients entirely eliminates the possibility of congestion or turning of corners.

(*f*) A fan with suitable drive is fitted in the front wall of the cabin, opposite the passageway, driving air through a screen, down which a constant drip of water can be maintained. This fan is capable of operation when the aeroplane is stationary on the ground. The rate of flow of the water is easily regulated from inside the cabin; an even and cool temperature can therefore be maintained in tropical countries.

(*g*) Lavatory accommodation is installed as follows:

(1) Lavatory pan. This is flushed into a receptacle which is easily detachable, for emptying and disinfecting. An anti-splash arrangement and a close-fitting cover are fitted to the pan.

(2) A washbasin, cupboard and drawers with a rack for bottles.

(*h*) A 15-gallon water tank is provided for use with the lavatory pan, separate tanks of smaller capacity being provided for this cooling apparatus, washbasin and for drinking. A tap is fitted to this latter in a position suitable for the dilution of disinfectants and filling chatties, etc.

(*i*) Racks are provided in the cabin for chatties.

(*j*) Ample door space is provided for rapid evacuation in case of emergency.

The length of the fuselage of the machine is 42 ft. 8 in.; span 68 ft.; height, 15 ft. 3 in. Two Vickers "Vimy" machines can be housed in an 80 ft. by 80 ft. hangar.

AEROPLANE CRASHES: ENGINE TROUBLES—A POSSIBLE EXPLANATION

By STANWOOD W. SPARROW

Automotive Power Plant Section, Bureau of Standards

Technical Note of the National Advisory Committee for Aeronautics

WHEN the daily paper tells that a plane has crashed and states a definite cause such as the fracture of a fuel line or the collapse of a wing, public confidence in the safety of aviation is shaken. It is easy to believe, however, that defects so glaringly revealed will be corrected at once. The real blow to aviation comes when no satisfactory explanation for the accident is forthcoming. Knowledge of what is wrong must precede any intelligent effort to make a thing right. A wrecked plane bearing mute testimony to the existence of a fault and a confession of ignorance as to the nature of the fault tends to contradict assertions that aviation has outgrown the experimental stage. To bring attention to one possible cause of such unexplained accidents this note has been prepared for the National Advisory Committee for Aeronautics.

In testing aeroplane engines at the Bureau of Standards it has happened frequently that the engine performance became erratic when the temperature of the air entering the carburetor was between 0°C (32°F) and 20°C (68°F). Investigation revealed the trouble to have been caused by the formation and collection of snow somewhere between the entrance to the carburetor and the manifold, probably at the throttle. Experiments in the carburetor test plant had shown the possibility of this trouble. In fact, a glass portion of the induction system made it possible for one actually to see the snow as it collected.

Proof scarcely less convincing was obtained during engine tests. That something was wrong became apparent from a drop in power. The manifold depression, the difference between atmospheric pressure and the pressure in the manifold, was greater than that usually obtained at full throttle at this speed. At the same time, measurements showed the rate of air flow to be lower than usual. Inasmuch as both of these effects would be produced by throttling the engine, they gave a clue to the source of trouble. In some cases the snow would continue to collect until it shut the engine down, while at other times after it had effected a decrease in power of from 25 to 50 per cent a portion would become dislodged and the engine would speed up. The test apparatus is arranged so that the air on its way to the engine passes over heating grids. If, while the power was still low, sufficient heat was applied to increase the air temperature 20°C (36°F), the power, manifold depression and air flow would soon regain their normal values. A few rather violent fluctuations of speed usually accompanied this period and can be attributed to the water passing into the combustion chamber as the snow melted.

Granting this trouble to be caused by the condensation of moisture from the air and the subsequent formation of snow, the removal of the moisture should prove as effective a cure as an increase in temperature. Fortunately, it was possible to do this and thus check the validity of this supposition as to the origin of the trouble. The engine test apparatus includes refrigerating coils which enable all the air taken by the engine to be colled to below —20°C (—4°F). This air is then reheated to the desired temperature. Air when cooled to

—20°C (—4°F) contains almost no moisture and no opportunity is offered for it to collect any during its passage from the heating grids to the engine. Under these conditions the engine operated satisfactorily at those temperatures at which difficulty was experienced with the air from which the moisture has not been removed.

The more serious the manifestations of this trouble, the more difficult it becomes to secure accurate data for record. Fluctuations of speed are violent and a stalled engine is usually the final result. A record of a few instances where it was possible to hold the speed reasonably constant are given as examples of the trouble in its milder stages. On February 14, 1921, with the engine operating at part throttle at 1,800 r.p.m. it was noted that the power was decreasing. At 1:06 P. M. readings of carburetor air temperature and manifold depression showed the former to be 10°C (50°F) and the latter 25.0 cm. (9.84 in.) of mercury. Heat was applied and at 1:08 P. M. the air temperature had risen to 38°C (100°F) and the manifold depression had dropped to 6.8 cm. (2.68 in.). Again the temperature of the air was allowed to drop and again a drop in power and increase in manifold depression resulted. With the speed maintained at 1,800 r.p.m., the throttle was opened wide and readings taken showing the air temperature to be 10°C (50°F), the manifold depression 11.1 cm. (4.37 in.) and the brake horsepower 86. Within two minutes the application of heat had resulted in dropping the manifold depression to 5.6 cm. (2.20 in.) and in raising the brake horsepower to 185. The foregoing results were all obtained at air densities corresponding to ground level. Similar conditions were found on February 23rd, at an air density corresponding to an altitude of 5,000 feet with the engine operating at full throttle at 1,600 r.p.m. With the air at a temperature of 30°C (86°F), the manifold depression was 2.9 cm. (1.14 in.) and the brake horsepower was 156. Eight minutes after the heating was discontinued, the air temperature had become 8°C (46°F), the manifold depression 5.1 cm. (2.01 in.) and the brake horsepower 120.

While in all of these instances it was a change in weight of charge that caused the drop in power, the magnitude of the decrease may have been influenced by another factor, a change in mixture ratio. If a carburetor does not maintain the air-fuel ratio constant at reduced loads, any unintentional throttling involves a departure from the desired mixture quality as well as a reduction in mixture quantity. To the reader familiar with carburetors in which changes in the area of a small passage between the float chamber and throat effect the mixture ratio changes, still another source of danger has doubtless suggested itself. This danger is that a collection of snow may block the connecting passage and cause a serious change in air-fuel ratio.

Discussion thus far may have emphasized unduly loss of power instead of what is probably the more serious effect, excessive fluctuations in power. Under these conditions a pilot is in exactly the same position as though his engine were controlled by a lunatic, opening and closing the throttle at will. Yet, in case of an accident, before an examination could be made the snow would have melted, leaving no evidence to confirm the pilot's report of trouble.

It is hardly worth while to attempt to predict from theoretical considerations at what temperature the trouble from snow formation will be most pronounced. It does seem desirable, however, to consider how much additional external heating is necessary to give reasonable assurance that the trouble will not occur. The weight of water vapor that a unit volume of air can contain decreases with decrease in temperature and the surplus condenses. Obviously if the drop in temperature be prevented there can be no condensation. The problem is to supply sufficient heat to completely vaporize the fuel so that no heat for this purpose need be withdrawn from the mixture. If the heat of vaporization of aviation gasoline be 75 cal. per gram (135 B. t. u. per pound) *, complete vaporization will produce a drop in mixture temperature of 26°C (47°F) with an air-fuel ratio of 10 to 1 and a drop of about 14°C (25°F) with an air-fuel ratio of 20 to 1. It is safe to assume that the mixture ratio used will fall within these limits. The above calculation assumes all the fuel vaporized and all the heat used in vaporizing the fuel to be supplied by the mixture, while usually a portion of this heat is supplied externally. From these considerations it appears that the addition of an amount of heat sufficient to increase the mixture temperature 25°C (45°F) should prove a reasonable guarantee of immunity from this trouble. The power loss that this would entail should not exceed 5 per cent.

This note is not intended as a sweeping recommendation of additional air heating for every aeropalne engine. Such a course would be akin to prescribing medicine for a patient without first being assured that he was really sick. The aim is to call attention to a "disease" to which aviation engines are subject, to describe its symptoms, and to emphasize its seriousness. Methods of prevention or cure can be consigned with safety to those vitally concerned.

* Ricardo, Automobile Engineer, February, 1921.

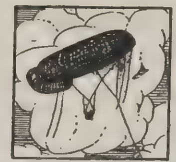
AIR LEGISLATION PENDING

THE following resumé gives the present status of aeronautic bills now before Congress:

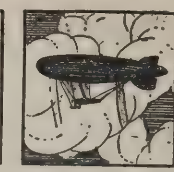
No.	*Senate Bills*	*Disposition*
2676	To Amend Sec. 56 of an Act entitled "An Act making further and more effectual provisions for National Defense and other purposes, approved June 3, 1916." Introduced by Mr. Wadsworth.	In the House
3299	Providing for the purchase of certain inventions, designs and methods of aircraft, aircraft parts aand aviation technique of Edwin Fairfax Naulty and Leslie Fairfax Naulty, of New York. Introduced by Mr. Thomas. *Note.*—A similar bill—H.R.11294 was introduced by Mr. Oldfield in the House Military Affairs Committee.	In the Senate Military Affairs Committee
3386	To provide for the assistance of civilian aviators in distress by authorizing the Secretary of War to sell at cost price at Aviation posts, or stations, gasoline, oil and aircraft supplies to persons in charge of civilian aircraft landing upon or near said posts. Introduced by Mr. Wadsworth.	At present in House Military Affairs Committee
3516	To authorize the Secretary of War, in his discretion, to furnish quarters at Langley Field, Virginia, to civilian employes of the National Advisory Committee for Aeronautics and for other purposes. Introduced by Mr. Wadsworth.	Before the House
4470	To regulate air navigation within the United States and its dependencies and between the United States or any of its dependencies and any foreign country or its dependencies. Introduced by Mr. Wadsworth.	In the Committee of Commerce
3348	To create a Department of Air, defining the powers and duties of the Director thereof, providing for the organization, disposition and administration of the United States air force, creating the United States Air reserve force and providing for the development of civil and commercial aviation. Introduced by Mr. New.	Recommitted to the Senate Military Affairs Committee Jan. 31, 1920

No.	*House of Representatives Bills*	*Disposition*
4469	Authorizing the President of the United States to make regulations and appointments covering participation by the United States in the work of the so-called International Aircraft Standards Commission. Introduced by Mr. Kahn.	In the House Military Affairs Committee
16151	To create a Department of Aeronautics, defining the powers and duties of the Secretary thereof, providing for the organization, disposition and administration of a United States air force and providing for the development of civil and commercial aviation, regulation of air navigation and for other purposes. Introduced by Mr. Curry.	House Military Affairs Committee

(*Continued on page* 139)



FOREIGN TECHNICAL DIGEST



Rigid Airships

This paper by C. J. R. Campbell, O.B.E., M.I.N.A., F.R.AeS. was read before the Cambridge University Aeronautical Society.

It discusses the various principles involved in the development of rigid airships for commercial purpose.

The particular field for the use of airships in commerce is in the less developed parts of the world where the existing competitive means of transport are relatively slow, and the undeveloped state of the country makes air endurances of often over 1,000 miles necessary. For instance, an economically designed airship should be capable of carrying out a journey of 1,500 to 3,000 miles at an average speed of 50 miles per hour, while it seldom happens that any existing means of transport would average 25 miles per hour over the same distance. Airships are not economical for high speeds as the efficiency (*i. e.*, carrying capacity÷total lift) falls away rapidly where extra speed is called for, due primarily to the extra weight of petrol required, and, to a less extent, to the increased weight of the more powerful machinery.

The type of airship most suited to commercial work is the rigid. This can vary from merely an envelope maintaining its transverse form by gas pressure, and its longitudinal form by a rigid keel at the bottom, to a built-up structure so arranged that it presents the general characteristics of a tube. The controlling surfaces are necessarily as near the axis of the envelope as possible, but all other weights are slung from the lower part of the hull. The power plant is divided amongst several units, partly to secure a high propeller efficiency and partly because no suitable engines of high power are available at present. The gas container consists of a number of distinct bags with not less than 6 inches of air space between them in order to minimise (*a*) the superheating, (*b*) the surging of the gas, (*c*) the loss of gas due to accidental damage of the container. The form of least resistance is a non-parallel body with a length diameter ratio of 6 or less. In designing the hull the forces to be considered are the local pressure exerted by each gas bag, local downward forces due to weights of parts, the aerodynamic forces due to the movements of the ship through the air, the propeller thrust, and mooring and handling forces. The control surfaces are fitted as far aft as is practicable and balanced whenever possible. The outer cover is composed of doped cotton fabric, laid with its length fore and aft. The final coat of dope is mixed with aluminium powder in order to reflect the sun's light and heat rays, and a previous coat is pigmented to absorb any rays not so reflected. The gas bags are made of cotton or silk fabric, lined with goldbeaters' skin, and supported to resist bursting by wires or cords.

The engines are distributed amongst several cars and usually drive two-bladed propellers through reduction gearing, the lower speeds enabling a higher propeller efficiency to be obtained. Arrangements for handling at a terminus should include mooring masts in order to avoid the necessity for getting the ship into a shed every time.

(*"Flight," 23rd December*, 1920)

Pescara Helicopter

Captain M. Lamé reviews the work that is being done in France with a view to solving the problems of the Helicopter. No fewer than five French authorities are experimenting with this type of aircraft, and each appear to have achieved an encouraging amount of success. Special prominence is given in this article to the Pescara type, which recently was taken up by the French Air Service and is now undergoing official tests. The body of this machine is like a racing automobile with a vertical mast bearing two propellers, which move in a horizontal plane, in opposite directions at about 200 revolutions per minute. Each propeller has six blades, or rather six wings, like a small biplane two meters square in size. From the pilot's seat in the car he can control the angle at which the wing propellers are set and so—theoretically at least—can control his forward, upward or downward flight. He can also control the direction in which the series of propellers rotate, working one against the other so as to make a brake action.

By doing this, and sloping the wings forward, Pescara claims to be able to effect a landing at the reduced speed of 50 centimeters a second. (*L'Aeronautique,"* January, 1921.)

The Lamblin Radiator

The problem of cooling aero engines has so far been somewhat inefficiently accomplished by the use of honeycomb radiators, usually mounted in the nose in a position somewhat similar to that employed in automobiles. With aircraft traveling at such high speeds, the resistance set up by a nose radiator is enormous, and therefore anything which can help to overcome this difficulty, without interfering with the primary function of the radiator, is worthy of careful attention.

M. Lamblin, a French engineer, has brought out a new design, specially adapted for use on aircraft, which has proved on tests to be considerably in advance of previous designs. In this article the general scheme of construction is clearly shown by various detailed illustrations. At each end of the radiator is an annular water-passage serving the purpose of the header and bottom tanks of the normal type. These two annular spaces are connected by the series of radially set flattened tubes which connect the two. Of these tubes there are two sets, one projecting out beyond the extreme radius of the end rings, and the other projecting inwards nearly to the center of the radiator. The water flow is straight through from one end to the other.

These radiators can be fixed in position by four bolts only, with the result that they are extremely accessible and interchangeable. The Lamblin radiator was used by the winner of the Gordon Bennett Race, and the writer expresses the opinion that it was M. Lamblin who really won the cup. (*L'Aerophile*, 1-15, January, 1921.)

1,000 H.P. Staaken Monoplane

This article gives a general description of the giant German all-metal machine which, for some time, was alleged to be designed for a transatlantic flight. The machine was completed at the Zeppelin works, Staaken, about September, last year, and has since undergone several extended tests. It was designed by Herr Küring and embodies all the latest devices in metal construction of the Zeppelin work.

The machine is a monoplane, of thick high-lift section, and of all-metal construction throughout. Four Maybach engines, each 260 h.p., are built into the wings, their housings projecting slightly above and below the wing surfaces. Inside the wings there is a narrow gangway through which a mechanic can crawl to the engine nacelles, thus enabling him to attend to the engines during flight, without having to come out in the open. The high position of the engines has also the additional advantage of keeping the propellers well clear of the ground. The two outer engines are about 16 feet apart from the center line of the machine, while the inner two are as close to the body as the propellers will allow. The petrol tanks are also placed inside the wings between the inner and outer engine nacelles.

The fuselage is of generous proportions and has ample accommodation for 18 passengers and their hand luggage. The pilot and engineer are situated above the cabin with their heads in the open. Two large double landing wheels are provided and are situated much wider apart than usual. A pair of smaller wheels protrude from the nose of the fuselage. The wing span is approximately 100 feet. Weight of machine, empty, about 1,200 lbs., and fully loaded, 18,700 lbs. The maximum speed is 110 m.p.h. (*Zeitschrift für Flugtechnik und Motorluftschiffahrt*, January 15, 1921. 8 illustrations.)

Dornier Machines

A general description is given of the more recent types of the Dornier product, DoCI, DoDI, DoGI.

The vast experience in metal construction of the Zeppelin works at Lindau is probably unequalled by any other European concern, and Herr Dornier's ability as a designer is sufficiently well known to command universal attention. The types described are not the latest product of the Lindau works, but the experience gained in their construction forms the principal features of their more up-to-date type, the DoGII.

The DoGI is a monoplane flying boat of all-metal construction (with the exception of the wing covering). Two Maybach engines of 260 h.p. are mounted high above the wings in tandem fashion, one driving a tractor and the other a pusher air screw. The clean general appearance of the machine and the simplicity of the bracing are noteworthy features. This boat was sold to the Swiss Ad Astra Co. and did quite a lot of flying in the autumn of 1919. The main characteristics are:

Span•........................69 ft. 4 ins.
Length ....50 ft. 6 in.
Weight, empty..................6,600 lbs.
Weight, loaded..................9,450 lbs.
Load/H.P. (lbs.).....................18.2
Load/sq. ft. (lbs.)....................11.1
Engines (2)..........Maybach, 250 h.p.

"Flug-Woche" 19 January, 1921.

NAVAL and MILITARY AERONAUTICS

Aerial Survey of Cyclone Swept Timber Zone of the Olympic Peninsula

Arrangements are being expedited for the co-operation of the Army Air Service with the Forest Service of the Department of Agriculture in making an aerial survey of the cyclone-swept timber zone of the Olympic Peninsula in the State of Washington. A detail of planes, pilots and observers will be made by the Commanding General of the Ninth Corps Aera who will co-operate with the District Forester, George H. Cecil, at Portland, Oregon, in the carrying out of arrangements.

According to reports, not since the coming of the white man to the New World, has there been a storm to compare in violence and in the extent of destruction with that which visited the Olympic Peninsula on January 29th.

Some accounts put the area of windstorm timber at 2,250 square miles. The area of worst destruction appears to lie in a strip thirty miles wide, extending from Gray's Harbor, near the southwest corner of the Peninsula, to Clallam Bay, on the Straits of San Juan de Fuca. While no accurate data is yet available, the loss of timber is estimated at from 8,000,000,000 to 12,000,000,000 feet board measure.

This disaster has not only resulted in the loss of public property, through the destruction of timber in the Olympic National Park, and in the loss of enormous quantities of State and privately owned timber, but still further destruction is threatened by forest fires.

In requesting the co-operation of the Army Air Service by detailing the necessary machines, pilots and observers to make an aerial survey of the region, the then Secretary of Agriculture, E. T. Meredith, called attention to the imperative need for the Government to take immediate steps to salvage the publicly owned timber which had been blown down and to assist in salvaging that which was State and privately owned, and especially to control as far as practicable the serious fire hazard.

"The first step," the Secretary of Agriculture writes, "is to make as promptly as possible a survey of the area as a basis for the plan of salvage and protection; and this can be done far more rapidly and conveniently from the air than by attempting to traverse these uprooted forests on the ground. This survey might be made by aerial photography even "if absolutely clear photographs could not be obtained on account of adverse weather conditions; or, if this were not feasible, through sketch mapping by observers in aeroplanes. It is especially desirable to determine the limits of the affected district, and the location of blown-down and of standing timber."

It is estimated that the cost of the survery from the air will not exceed $500, approximately. The immense advantage, then, in making such surveys from the air instead of on the ground will be obvious. The saving in money, in time, in men employed, is of immeasurable importance.

French Decoration for Colonel Steichen

In conferring, in the name of the French Government, the decoration of the Legion of Honor upon Lieut. Col. Edward Steichen, A.S.R.C., formerly Chief of Photographic Section, A. E. F., and president of the Inter-Allied Aerial Photographic Commission, General Collardet, Chief of the French Military Mission to the United States, said in part:

"No branch of the Army constituting the American Expeditionary Forces was more popular in France than the Air Force. This was not alone because the daring aeronauts composing the various squadrons were themselves so worthy of admiration, but because the qualities which they represented with such distinction belong to all America. Particularly worthy of admiration was the brilliant manner in which the organization work of the various branches of the American army was conducted. It is in recognition of the distinguished work of Colonel Steichen, as Chief of the Photographic Section, that the Republic of France confers upon him the decoration of the Legion of Honor."

The interesting ceremony by which former Lieut. Col. Steichen became a Chevalier of the Legion of Honor took place March 22d, in the Trophy Room of the Army Air Service, the walls of which are decorated with the emblems presented by the women of France to the different squadrons comprising the flying force of the A. E. F.

Government Must Pay for Aviation Site

Washington.—The Supreme Court on March 28 sustained California courts in a decision growing out of the condemnation by the Government of lands on North Island, in San Diego Bay, for a naval aviation site.

The Coronado Land Company, owners of the land taken, won a verdict for $5,000,000, with interest from the date of award. The Government took an appeal on the ground that the jury had included certain tidewater property in that to be paid for when title to such land was clearly in the State or the Federal Government.

The original grant from Mexico made specific reservation as to its rights for national defence and the Government claimed that it fell "heir" to these reservations. The Supreme Court ruled that the Government could not dispossess private owners under such a right.

The Mexican grant mentioned the "anchorage of ships" as one of the boundaries, and this was held to include the submerged land in dispute.

Naval Textbooks for Sale

Acting Secretary of the Navy Theodore Roosevelt authorizes the following: To meet an increasing demand for authentic aeronautic information the Navy Department has arranged for the sale at a nominal price of certain of the books which are used so successfully in the schools and stations of Naval Aviation.

These handbooks explain in detail the handling of large flying-boats with reference particularly to unpacking and assembling. The titles of these handbooks which from now on may be obtained from the Superintendent of Documents, Washington, D. C., are as follows:

The HS-1 Flying-boat handbook (price 30 cents) a book of 40 pages and 27 charts or plans.

The H-16A Flying-boat handbook (price 30 cents) containing 41 pages and 30 plans and diagrams.

The F-5-L Flying-boat handbook (price 65 cents) embracing 47 pages and 9 diagrams.

As used by Naval Aviation, these handbooks cover every phase of unpacking, assembling, and handling the three types of boats mentioned, and are undoubtedly the most exhaustive treatise obtainable on the subject.

Improved Gas Mask for Navy

Experts in the Bureau of Construction and Repair have perfected a mask which is a big improvement over the clumsy masks used during the war. It is designed for use in the open, in anticipation of gas bomb attacks against battleships, and also may be used by submarine crews to protect them from the deadly carbon monoxide gas.

Poland Decorates U. S. Flyers

Poland has bestowed the "Virtuti Militari," which is her highest decoration, on Capt. Kenneth Shrewsbury of New York City and Capt. Harmon Rorison of Wilmington, Del. Both were members of the Polish Air Force.

Aero Club of Massachusetts

The club headquarters is now at 16 Somerset Street, Boston, and is ready for inspection. Through the members of the club many pieces of furniture and also a few trophies have been either loaned or given outright which make the club quarters very presentable. Through the courtesy of Mr. John Lavalle, member, two of his paintings are shown, one of ships in formation and the other a single plane among the clouds. Wednesdays is the "at home" day and members may bring their friends to lunch and discuss aviation of the past and of the future as well. Luncheon is served every day to those who desire it. Out of town guests, are welcome at the Boston Club, at 16 Somerset Street, any time that they are passing through Boston or are in town for any length of time.

As to landing fields in and around Boston, this Club is doing its utmost to bring about interest and co-operation with all representative bodies in view of obtaining a suitable site for a Municipal Landing field for this city. Mr. Nathan Heard of the Boston Chamber of Commerce has consented to serve as Chairman of a Committee that has just been appointed by the Aero Club of Massachusetts to represent the interests of the Chamber of Commerce and the Postal Department. Other organizations that are to be consulted and be represented are the Aero Club of New England, The U. S. Army, U. S. Navy, Archie Club, Aero Club of Massachusetts, commercial aircraft companies, and other bodies are to be invited from time to time.

FOREIGN NEWS

Surrender of German Aircraft

"Det danske Luftfartselskab" has had to give up its Friedrichshafen seaplane, which the Germans had sold cheaply, but unauthorized according to Allied views. Accordingly it is uncertain whether the Copenhagen-Warnemünde service will be resumed in April in conjunction with the air line to London.

A Levantic Seaplane Circuit

The Venetian Aero Club announces a grand Levantine circuit for seaplanes this year, starting from and returning to Venice via Fiume-Athens-Salonika-Constantinople-Smyrna-Athens-Brindisi.

Considerable activity is reported from Rome, Naples and the South, and from the seaplane firms.

New Air Lines to be Established in Japan

Mr. Yukiteru Ozaki has announced that he will open an air line between Tobashi, Miye Prefecture, and Toyama, and the Oriental Park Co. will join with him and establish the company with a capital of 10,000,000 yen.

Another air line will also be opened between Tokio and Osaka and take both passengers and cargo. The company will be established, also with a capital of 10,000,000 yen, by Mr. Ryokan Tachibana, with the help of Mr. Takichi Hashimto.

The former will begin to operate in March of this year.

The Christiania Meeting

The Aviation Meeting at Christiania has not proved the success that was anticipated, owing to the number of crashes that took place.

No Finnish pilots took part in the meeting owing to their being forbidden to cross Sweden.

As the result of a subscription raised by the Swedish Aero Club, five Swedish army pilots were chosen to take part in the meeting: Lieuts. Gardin, Adilz, Segebaden, Philipson and Sjorholm.

Lieuts. Gardin and Adilz left Umea at 10 a. m. on March 1 and landed at Falun at 5 p. m. out of petrol. They left Falun the next day and arrived at Kjeller, outside Christiania, on the same day. They were flying 2-seater Swedish built S.18s (260 h.p. Mercédes).

Lieuts. Segebaden, Philipson and Sjorholm left Malmstadt on March 1 for Kjeller on Swedish-built Phœnix scouts (200-h.p. Benz).

Lieut. Sjorholm arrived at Kjeller in 2½ hours, Lieut. Philipson landed at Arvika with engine trouble and left ten minutes later, eventually arriving at Kjeller, while Lieut. Segebaden landed at Arvika with a broken wire. He returned to Malmstadt for another machine and started next day at 10 a. m., landing at the Norwegian capital 3 hours later. He then took the train back to Arvika and flew his original machine, now repaired, on to Christiania.

From later news received, it appears that all the Norwegian pilots crashed, two badly, and of the five Swedish pilots present, one, Lieut. Segebaden, was killed. He was spinning a Phœnix Scout when the left-hand bottom plane folded up and let him down from 300 metres. Only one Swede flew back to Malmstadt, so it appears from the little news received that the meeting had its very fair share of "bois cassé."

The prizes, amounting to 5,000 kr., with cups, two of which were presented by the Aero Club of Sweden, were all awarded to Swedish pilots, for what reason it at present is not known, except that perhaps Sweden preserved more machines, to wit, one, in a flying condition than Norway.

It is hoped that further information will be forthcoming, that will give an account of the actual meeting, and perhaps account for the allocation of the prizes.

The Commercial Air Pilots' Association of Canada

A further meeting of commercial pilots was held at Camp Borden on Wednesday, February 23rd, for the purpose of more definitely deciding the policy that is to be pursued for the present year. The decisions arrived at are as follows:

1. Too much stress cannot be laid on the necessity of commercial work being carried out by capable and efficient pilots. The placing of the right man in the right place is probably the most important field of endeavor for the present year. In the past, to put it mildly, unqualified success has not been attained, and the development of aviation in Canada will receive serious setbacks unless air operations are conducted by men of intelligent experience.

2. The question of establishing standards of pay for pilots is to be left open, at least for this year, and until such a time as conditions would seem to warrant an effort in this direction.

3. Everything possible is to be done to secure the support and cooperation of commercial pilots, all of whom should be induced to join the organization.

4. An endeavor is to be made to have complete information on all subjects in connection with aviation on file, together with lists of the names of reliable pilots, mechanics, photographers, navigators, etc., the names and objects of all commercial enterprises, machines used, and the degree of success attained.

The association must obtain and keep this information up to date largely through its own members. This will enable the pilots as a whole to benefit from the experience of the individual.

5. It was cnsidered desirable to offer companies engaged in aviation access to the association files, and in return to get from them a grant to help defray expenses incurred in compiling.

When thoroughly organized the association would be in a position to offer advice on practically any subject in connection with aviation. Correspondence with the secretary at Camp Borden is invited.

Australia's Air Force

Recently we published details of the constitution of the Australian Air Council and Air Board. It is now announced that the Australian Air Force will consist of eight squadrons, with headquarters at Sydney and Melbourne. Each squadron will comprise eighteen machines in war formation, with three flights of six machines each. The Avro will be the standard land machine, and a large number of Avros have been presented by the Imperial Government. The suitability of Australian timbers for aeroplane construction is being tested, and it is hoped to obtain wood sufficiently light to replace spruce and to meet the requirements of the British Air Ministry.

An Italian Service

From Rome it is reported that a seaplane service is about to be started between Brindisi, Corfu, Crete, Derna and Alexandria. The service will be made by Italian seaplanes, which will carry passengers and mails.

Resumption of London-Paris Air Service

As a first result of the Committee of three and its consultations with representatives of the aircraft industry and transport firms, a temporary resumption of the British air services to the Continent was made on Saturday last, when Messrs. Handley Page and, on Monday, Messrs. Instone Air Line recommenced operations.

On the Monday, Lord Londonderry, with several Air Ministry officials, visited the London Terminal Aerodrome at Croydon to witness the re-starting at 12:30 p. m. of Messrs. Instone's Vicker-Vimy-Rolls plane (the "City of London") for Paris.

Capt. F. L. Barnard, who was the pilot on this occasion, brought his total of cross-Channel "flips" to 352 with this trip. In addition to passengers—one of whom was Mrs. Barnard—the "City of London" carried mails.

In conversation afterwards to members of the press, Lord Londonderry said: "I hope this inaugurates a new era in civil aviation and that Great Britain will take a leading and foremost place in it. I trust this will be the beginning of services that will radiate from this country through Europe and to the British Dominions overseas."

The Handley Page machine, which left Cricklewood aerodrome on Saturday for Paris, returned on Monday to London with seven passengers and luggage.

No British Air Service has been running, it will be remembered, since the end of February, when Messrs. Handley Page had to close down their services owing to the "cut" in fares due to the French Government subsidy to French services, which resulted in a reduction of fares to six guineas. The machines to be used for a start will be Vickers Vimy-Commercials (Rolls-Royce engines), Handley Pages (Rolls-Royce engines), and DH-18's (Napier Lion engines). The latter type of machine is fully described elsewhere in this issue. On figures given by Mr. H. White Smith at the Air Conference at the Guildhall last year this machine, it may be remembered, proved the most economical to run on a service like the London-Paris. We understand that the Air Ministry have purchased two of these machines from the liquidators of Aircraft Transport and Travel, and a third, which is now nearing completion (and which has formed the subject of our descriptive article in this issue) at the Stag Lane works of the de Haviland Aircraft Co. at Edgware, from that firm. These machines, it is understood, will be hired out to firms which will run them on the Continental Service.

The new fares on the resumed British services will be as follows: London-Paris, single fare, £6 6s.; return, £12; goods, 1s. per lb. up to 100 lbs., 10d. per lb. for each lb. over 100 lbs. The air mails, which were temporarily surrendered to the French services, will be returned to the British services, and we understand that Messrs. Handley Page and Messrs. the Instone Air Line will carry the mails alternately.

The arrangement just outlined is only a temporary one, subject to the establishment of a more permanent scheme. In the meantime it is very gratifying to know that British firms are not to be allowed to die owing to lack of Government support. What the final arrangements will be is at present impossible to say, as no definite scheme has yet been found which entirely satisfies both the Air Ministry and the firms of constructors and operational companies involved. It is hoped, however, that a scheme which is satisfactory to all will quickly be found.

German Maps of Holland from the Air

Very suggestive information was published last week in Holland in the *Telegraaf*, showing the anticipatory work by the Germans during the war. This Dutch paper prints a number of reproductions of German bird's-eye maps of Holland taken from the air. The collection comprises a total of 30 maps, headed "Luftorienterungskarten: Holland"; they are marked "secret," and they were printed by the German Admiralty in 1916 and 1917.

The fact that two or three years after the outbreak of the war the Netherlands were still considered as a possible "Angriffsobjekt"—object of attack—for German airmen is not without interest even now, and proves again how thoroughly Germany's activities in neutral countries were carried out. Forts, railway bridges, wireless stations, gasworks—indeed, all places of military and economic importance—are marked on the maps.

Position of Aviation in Denmark

The Danish Aircraft Company, Danske Luftfartsaktiebolaget, has given nearly all its personnel three months' notice. The cause for this is the extreme uncertainty with respect to the foreign air lines and the improbability of the resumption of air traffic between Copenhagen and foreign towns.

Aviation in Brazil

Of considerable interest to the future of aviation in Brazil is the fact that Edú Chaves has combined with Orton Hoover to promote "aviation weeks" in the interior of the State of Sao Paulo. It is their intention to organize landing grounds in various parts of the interior, as well as to visit the towns of Campinas, Mogy das Cruzes, Pirassununga, Itepetininga, and others which already have more or less bare patches in their vicinity which are proudly pointed out to the interested visitor as "aerodromes." However, all things must have a beginning. It is our opinion that some of the most useful work before the flying craft in this country is that entailed by a successful postal service following the lines of the big rivers. We are all told that the Amazon is dead, or perhaps only sleeping, at the present time, but a glance at the map will reveal that large rivers in the south and middle-east of Brazil exist.

Edú Chaves is the first man to fly from Rio de Janeiro to Buenos Ayres, which feat he performed a few weeks ago; and Orton Hoover, an American who served in the American Aviation Corps during the war, is well known in Rio and Sao Paulo flying circles as the proprietor of the aviation school at Indianapolis, about ten kilometers south of Sao Paulo. He has several Curtiss Oriole and JN machines, and is converting a Curtiss with an engine of 150 h.p. into a seaplane, which he intends to fly from Sao Paulo Light and Power Co.'s dam at Santo Amaro, which is about fifteen kilometers from the city. Some interest attaches to this, as it will be the first occasion on which a hydroplane or flying-boat has been seen in Sao Paulo, though, of course, many are to be seen around Rio de Janeiro. He is turning out a number of pilots, and is incidentally doing a great deal in the way of practical propaganda work for the North American manufacturers.

ELEMENTARY AERONAUTICS *and* MODEL NOTES

The Classification of Model Aeroplane Types

(Concluded from page 113)

Types of Scientific Models

Models are of the "pusher" or "tractor" types. When the propeller is at the rear of the main wing, it is known as a "pusher"; when the propeller (really a tractor "screw") is forward of the wing, it is called a "tractor."

Whether pusher or tractor, the model may be a monoplane, biplane, triplane or (when more than three main superimposed wings are employed) a multiplane. Any of these arrangements may be placed in tandem; for instance, Langley placed two main wings one behind the other in monoplane fashion. The big Caproni "Triple-Triplane" employs three sets of triplane wings, one behind the other.

Launching

The arrangement of launching a model offers further variation in its design. A model with no landing gear is usually "hand launched" although it is possible to start it by means of some mechanical launching device which is not carried in flight. When models are designed to fly from the ground under their own power, wheels or skids are used. When started from the water, suitable floats or pontoons, boat-hull or flotation gear is used.

An amphibious model is arranged with a combined land-and-water gear which will allow it to float on the surface of the water or to run on the ground before or after flight.

Landing Gears

The simplest form of landing gear consists of three skids; a combination of two wheels and a skid is better, but three wheels are usually used.

In a "seaplane" model, floats or pontoons take the place of wheels or skids. A "flying boat" model is one in which the single central hull or boat provides the entire buoyancy for flotation. It is usual to provide a flying boat with auxiliary floats to assist the lateral stability in taking off and alighting on the water.

Amphibious models may be of the seaplane or flying boat types. Real aeroplanes of this type are used for launching from the decks of battle-ships; in returning to the ship they either land on the deck or in the water alongside the ship where they can be hoisted aboard.

An Italian Engine Design

A prize is being offered by the Italian National Aerial League (L. A. N.) for a small aero engine not exceeding 50 h. p. The engine must be fitted with independent dual ignition and dual oiling system, both of which must be capable of being used simultaneously. It also must be made proof against water or other impurity in the gasoline supply and have dual controls and dual distribution gear. Although not specified, one of the essential features of the design, devices to prevent loss of power at altitudes are desirable. The desirable weight limit is 2 kilograms (4.4 lbs.) per horsepower.

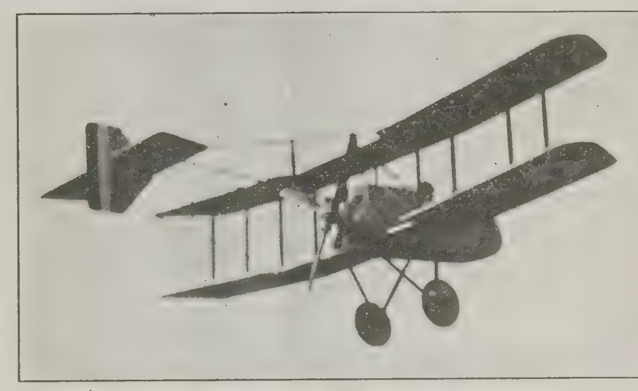
The Physical Properties of Air

The principal elements of air, oxygen and nitrogen, exist in the following proportions: weight—oxygen, 23%; nitrogen, 77%; volume—oxygen, 21%; nitrogen, 79%. Actual determination has been made of the weight of a cubic foot of air at atmospheric pressure at sea level at a temperature of 60 degrees Fahr.; this weight is .0764 pounds. As changes in the density of the air have a direct relation to changes of temperature and pressure, the weight of a specified air volume varies according to temperature and pressure.

The great quantity of air constituting the atmosphere exerts enormous pressure upon the earth. At sea level, with the barometer registering 30 inches and at a temperature of 32 degrees Fahr., the average air pressure is 14.7 pounds per square inch.

Scale Models Propelled by Compressed Air Engines

In building scale models with compressed air engines, it is sometimes difficult to retain good proportions owing to a rather awkward distribution of the weights. This drawback is minimized when the builder selects one of the Pusher type machines, as illustrated in the photograph above, for in reducing it in size it is possible to retain fairly accurate proportions without changing the balance.



A 2-foot scale model of the British F. E. 8 Pusher, a type especially suitable for installation of a compressed air engine and tank

As the photograph shows, it is possible to put the tank forward in the body or nacelle. The employment of a Pusher propeller with four blades serves to keep the diameter in reasonable proportions and has a further advantage of protecting the engine which really is the most delicate and costly part of the model. The model illustrated above, while American built, is a reproduction of the British F.E.8 Pusher, one of the most successful of its types.

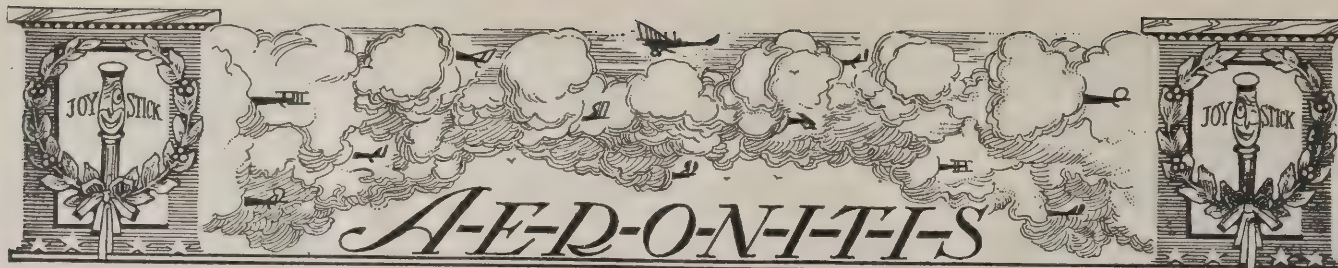
German Gliding Contest

The gliding and soaring flight competition which was held in the summer of 1920 in the mountains of the Rhön is to be followed by a similar competition in 1921. This competition will be held under the patronage of the "Wissenschaftliche Gesellschaft fur Luftfarht" (Scientific Society for Aeronautics), of Berlin, and will be managed by the League of German Model Aircraft and Gliding Clubs. The object of these competitions is the experimental development of flight by the aid of the internal forces of the wind—otherwise soaring flight. The subject has considerable scientific and a distinctly sporting interest.

It is desired to ensure as far as possible that continued progress be made in the art of soaring, and at the same time to encourage the sporting interest in the competition. The meeting is to take place in August, 1921, at the "Wasserkuppe," the scene of the 1920 meeting. First prize will be awarded for the longest duration of glide attained at the meeting, subject to the duration thereof exceeding 5 minutes, and to the difference of level between starting and alighting points being not more than 50 metres. That is, the prize will only be awarded provided that a considerable advance is made upon the 1920 results. Other prizes are to be awarded for the glider which glides for the greatest distance, and for that which shows the slowest rate of a descent. A number of other prizes are at the free disposal of the judges. The total prize fund is 100,000 marks, and the first prize—for the longest duration—is to be 30,000 marks.

Believing that the problems of soaring flight have a more than national interest, and that international co-operation in the matter will lead to a more rapid and complete solution thereof, the promoters have decided that this contest shall be open to all nationalities, and would-be competitors may obtain full information as to the conditions of entry from the offices of "Rhön-Segelflug Wettbewerb, 1921," Frankfurt-on-Main, Bahnhoffplatz 8.

Recent experimental work with gliders in Germany has, it is stated, produced remarkable results, in particular in tests made by Herren Peschke and Wenk in the Black Forest, and by Herr Harth. The latter has made flights of up to 5½ minutes in duration, accompanied by very slow rates of descent, and it is expected that the 1921 competition will produce surprising results.



A Bright Spark

"Owens is a sort of human dynamo."

"That fellow! Why, he hasn't enough energy to work and pay his bills."

"Exactly. Everything he has on is charged."

Dry!

One swallow may not make a summer, but the right swallow sure makes you feel like a millionaire.

Progress

Aviator—I think the world of you.

She—The world isn't very hard to get around, nowadays.

Wind Up

"James, I wish you wouldn't run over so many people."

"Cop couldn't catch us, madam."

"I know, James, but it gives me a terrible jolt."

Contact

Lieutenant—Would it be wrong for me to kiss you on the cheek?

She—Well, it might be a little off color.

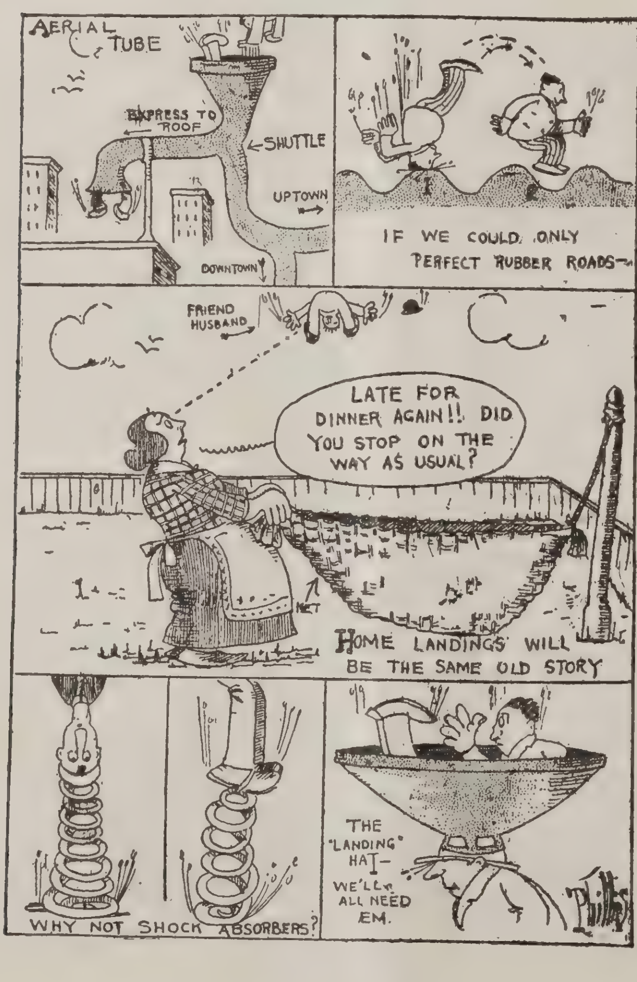
Old Soldier

Cadet—Fred, if you were at a dance and the room was suddenly plunged into darkness, would you commence to light out?"

"Nope, I'd begin to make connections."

"Keep away from that winch!" yelled the salty boatswain's mate to the colored mess boy who had just enlisted.

"Mah goodness, man," replied the ink spot, "dar ain't no women on dis heah boat."



Where to Go for Your Vacation—

Cranks to Peculiar, Mo.
Smokers to Weed, Cal.
Newly Married Couples to Bliss, Mich.
Sewing Girls to Scissors, Cal.
Drunks to Brandywine, Pa.
Prize Fighters to Box, Kan.
Lovers to Spoonville, Mich.
Widowers to Widows, Ala.
Tramps to Grubtown, Pa.
Actors to Star City, Ark.
Paupers to Charity, Kan.
Sleepy Heads to Gap, Pa.
Lawyers to Fee, Fla.
Poets to Parnassus, Pa.
Aviators to Plainfield, Conn.

"Turn Out the Guard"

A society woman wrote to an army officer at Camp Dix:

"Mrs. John Sears D'Voille requests the pleasure of Captain Smith's company at a reception on December 4th."

The next day she received this note of acceptance:

"With the exception of fourteen men who, I regret to say, have a week each in the guard house, Captain Smith's company accepts with pleasure Mrs. D'Voille's invitation for the 4th of December.

The K-Det's Last Hop

(Apologies to Robert Service.)

Out on the Post Field airdrome,
On a cold December day,
Beside a cracked-up DH-4,
A dying K-det lay.

His comrade stood beside him,
With low and drooping head,
Listening to the last words
The dying K-det said.

"Tell my sweetheart, down in Nocotee,
My time on earth is past;
I am going to take another hop—
And this hop will be my last.

"I'm off for a better field," he said,
"Where everything is bright,
Where you can get any ship you ask for,
And you can fly all day and night.

"At this field they will not ground me.
And, though I haven't tried before,
I shall fly their Spads and Nieuports,
And lay off the DH-4.

"There they have no traffic schedules,
They don't tell you where to turn,
Flight commanders do not seem to care
How much gasoline you burn.

"There you can take-off cross-winded,
You can fish-tail when you land,
And you can stund a blimp or parachute,
If you've only got the sand.

"But the crew chief says she's ready,
On the take-off I'll Chandelle.
Tell the O. I. C. of Flying
To send his 'flying rules' to ——."

His eyelids dropped, his head fell back—
He had sung his last refrain.
The other cadet swiped his goggles and wings,
And took-off again.

K-Det E. R. Davies, Air Service.

(Continued from page 133)

12134	To create a Department of Aeronautics, defining the powers and duties of the Director thereof, providing for the production, dedevelopment, designing and maintenance of aircraft and other purposes. Introduced by Mr. Hull.	House Military Affairs Committee
11206	To create a Department of Aeronautics, defining the powers and duties of the Director thereof, providing for the development, production, operation and maintenance of aircraft and providing for the development of civil commercial aviation. Introduced by Mr. Morin.	House Military Affairs Committee
13468	To prohibit the use of governernment aircraft insignia by other than government aircraft. Introduced by Mr. Volstead.	In the Committee on Judiciary
13803	To make more effectual provivisions for the aerial defense of the United States and to provide for the concentration of the National air strength. Introduced by Mr. Kahn.	House Military Affairs Committee
14061	To regulate navigation in the United States and its dependencies and between the United States and any of its dependencies, and any foreign country and its dependencies. Introduced by Mr. Kahn.	Committee on Interstate and Foreign Commerce
14137	To create a Bureau of Aeronautics in the Department of Commerce and providing for the organization and administration thereof. Introduced by Mr. Hicks.	Committee on Appropriations
14368	To provide revenue, encourage domestic industries and make provisions for the National Defense by the elimination through the assessment of special duties, of unfair foreign competition in the sale of aeroplanes imported into the United States and for other purposes. Introduced by Mr. Tilson.	Senate Committee on Finance
No.	*Navy Bills*	*Disposition*
12303	To continue certain appropriations for securing lands for aviation purposes. Introduced by Mr. Britten.	House Committee on Naval Affairs
13042	To prohibit the use of naval insignia by other than naval aircraft. Introduced by Mr. Volstead.	Committee on Judiciary
14123	To create a Bureau of Aeronautics in the Department of the Navy. Introduced by Mr. Hicks.	Before the House
4478	To create a Bureau of Aeronautics in the Department of the Navy. Introduced by Mr. Keyes. *Note.*—This was included in the Naval Appropriation Bill as reported from the Senate Committee.	Before the Senate

(Continued from page 129)

sufficient energy, when placed near the engines, to completely balance out the disturbance in the tail coil when the latter was in a position to have the greatest flux linkage with the magnetic fields of the engine ignition system.

Time and facilities did not permit the continuing of experiments to arrange a means of automatically varying the coupling between the aerial circuit and compensating coil so that a complete balance could be had at all times without the manipulation of the coupling coils when bearings were being taken. No doubt some sort of a device could be developed such that the coupling between the coil aerial and compensating coil could be varied so as to produce a proper balance without the manipulation of any equipment except revolving the tail coil.

(To be continued)

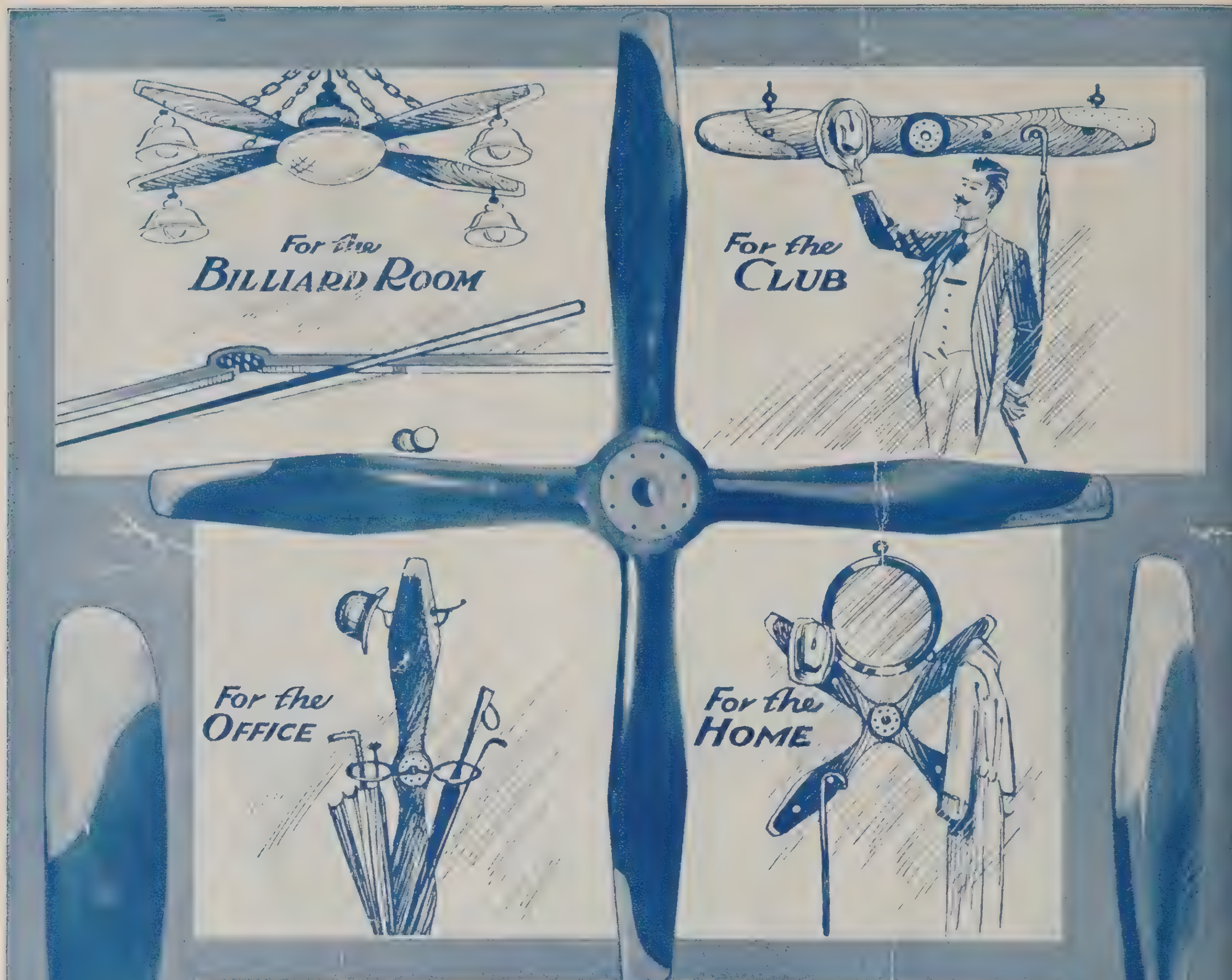
AERIAL AGE WEEKLY

VOL. 13, No. 7 | APRIL 25, 1921 | 10 CENTS A COPY

Greenwich Country Club Golf Course, Photographed by W. L. Hamilton, for the Fairchild Aerial Camera Corp.

Aeronautics in the Universities

PUBLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY


For the
BILLIARD ROOM
For the
CLUB
For the
OFFICE
For the
HOME

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIII NEW YORK, APRIL 25, 1921 NO. 7

AERONAUTICS IN THE UNIVERSITIES

AERONAUTICAL engineering can only be based upon those fundamental principles which are common to all branches of engineering. The fundamental courses provided in the universities and colleges give this basic instruction, but even the many subjects which are included do not encompass the whole problem. There is, for instance, one particular section of the subject which cannot be dealt with in an adequate manner. This relates to the determination of the external forces acting upon aeroplanes and the particular shapes which must be given to wings and bodies so as to obtain maximum lift at any particular speed, the greatest degree of suitability, and at the same time the minimum resistance to friction and other aerodynamic losses. In this country the only places where such experiments could be carried out are at the Engineering Division, McCook Field, the Massachusetts Institute of Technology, Langley Field, and the Curtiss Aeroplane & Motor Company, where wind tunnels are available. No university can take up this part of the subject without installing very expensive apparatus and setting apart special members of the staff to carry out essential research.

The whole matter seems to be one of endowment. There are five of the universities that can afford the expense. If there were a great and flourishing aircraft industry, we should say that it was the duty of that industry, from motives of self-interest alone, to find the money for the research work which still remains, and will always remain, to be done. But the present prospects of equipping the universities from this source are not encouraging. It would really seem to be a matter of private munificence. If we are to maintain our position in aeronautics, all the research work possible must be done, and the more experiment and research is multiplied over a number of centers, the better it will be for the future of the industry.

An Excellent Example

STIMULATED by the extraordinarily poor showing of British pilots in the two international events of outstanding importance—the Gordon-Bennett Cup Race and the Schneider Cup Race—the Royal Aero Club of Great Britain has appropriated £1,000 towards the expenses of British entrants. Having the same stimulus on this side of the Atlantic for greater effort this year the Aero Club of America could not do better than to offer some such tangible form of co-operation to prospective American competitors.

New Test for Air Transport

TWO new air lines in widely separated regions of the globe have recently been announced and will soon be put in operation. One of these is the line from Ramleh, southeast of the Mediterranean port of Joppa and a few miles inland from the Palestine coast, across the Syrian desert, which in summer is one of the hottest lands of the earth, to Bagdad, in the Mesoptamian valley; the other is a line from Reykjavik, the capital of Iceland, to the British Isles, and thence to Copenhagen, Denmark.

The preliminary survey of the Palestine-Bagdad line was made in February, 1920, when Lieutenants Parer and Mackintosh flew over the route; this was supplemented by the work of an aerial expedition sent from Cairo to establish aerodromes, supply stations and landing stations across the desert. The distance is about 900 miles.

Iceland early manifested an interest in aerial service because it offered a solution of the island's problem of inland communication in winter and of quick transportation to and from the continent of Europe. A year ago an Iceland company purchased a small fleet of aeroplanes. These stood the severe winter test so well that the company early this year increased its fleet by several new American aeroplanes and flying boats. The route of the new service will be from Reykjavik to Leeds, England, and from there to Copenhagen, a distance of 1,600 miles.

The purpose of both lines is to supply safe and regular transportation service between points off the traveled routes and the rest of the world, a connection which the air machine at present appears more able than anything else to furnish. These two routes, one over the intense heat of the sand desert, the other over the snow and ice of the arctic region, seem to afford as severe a test of the effect of climatic conditions upon aerial transportation as it would be possible to devise.—*Editorial in N. Y. Herald.*

The News of the Week

Denby Presents Naval Appropriations

Washington.—Estimates for the Navy Department sent to Congress last session by Secretary of the Navy Daniels, but criticised and turned down as extravagant by Republican leaders, were resubmitted April 14th by Secretary of the Navy Denby.

He called for a total approximating $31,000,000, of which $12,500,000 is for the remainder of the current fiscal year ending next June 30, and $18,500,000 is for the fiscal year 1922.

Congress was informed that the work of the department and the heads of several employees are endangered through cuts in the estimates. Of the sum required for the current fiscal year $6,600,000 is for fuel and transportation, and about $5,800,000 is to be expended for maintenance under the Bureau of Yards and Docks.

For next year's funds, to be part of the pending Naval Bill, Secretary Denby requested authority to construct aeroplane carriers.

"The development of the aeroplane," Mr. Denby wrote: "has reached a point where it is obvious that the fleet must at all times be accompanied by aeroplanes for both offensive and defensive positions, and, while the fighting ships may be able to carry a few aeroplanes, by far the greater number needed must be carried on large, specially designed vessels of great speed and endurance. The General Board has recommended that two of these vessels be laid down as soon as possible and this recommendation meets with my hearty approval."

An additional appropriation of $250,000 to $350,000 is requested to prevent the reduction of nearly fifty clerks in the Bureau of Navigation after July 1.

Pennsylvania Aero Club in New Quarters

The Aero Club of Pennsylvania have established their headquarters and club rooms at 1421 Chestnut Street, Philadelphia, Pa., and are to be congratulated on the aggressive campaign which they are making to arouse interest in aeronautics to enlarge their membership list.

It is expected that there will be shortly available for the use of their members a comprehensive aeronautic library and all of the aviation magazines will be on file.

Every Friday night will be club night and the regular monthly meeting will be held on the third Friday of each month.

Mr. Joseph A. Steinmetz is president of the club and Mr. George S. Gassner, secretary and treasurer.

Detroit News Trophy

The Detroit *News* has offered a trophy to be known as the Detroit News Aerial Mail Trophy, which will be competed for during the Pulitzer Trophy meet at Detroit, September 8-10.

Liberty Motor Builders Trophy

Liberty Motor Builders' Trophy will be offered for a race of Army observation aeroplanes in the Pulitzer Trophy aerial meet, September 8, 9 and 10. The trophy is to be distinctly a Detroit proposition, in view of the fact that the Liberty engine was practically a product of Detroit factories. With this in mind, the committee in charge of the air race meet for the Aviation Country Club, gave a luncheon at the D. A. C., to which a number of Detroit artists were invited.

The committee requested that the artists submit sketches on or before April 25, incorporating their ideas for a magnificent trophy for this race. The artists will engage in a competition for a prize, the nature of which has not been determined.

That the artists might get the "spirit of the Liberty motor," Lieut. Harold H. Emmons, who was in charge of the production of this engine, related the problems of designing, production and placing the aircraft engine at the front and in the hands of the Allies. Col. S. D. Waldron, chairman of the A. C. C.'s race committee; Col. J. G. Vincent, one of the designers of the engine, E. Le Roy Pellitier and William B. Stout discussed various phases of the engine.

To Test ZR-2 Commercially

Immediately following the arrival in this country in July of the rigid airship ZR-2, now nearing completion in England, the Navy will begin experiments to determine the feasibility of the use of rigid airships for commercial purposes. Plans now under consideration in the Department include long distance flights by the ZR-2 that will cover practically every section of the country.

Mooring masts, which have now proved to be a satisfactory method of mooring out large airships, will be erected at Chicago and other points West, to accommodate the ZR-2 at intermediate stops between the Atlantic and Pacific coasts. Arrangements are now being completed for the ZR-2 to make a trip, shortly after her trans-Atlantic flight, to Chicago, carrying a message which President Harding will be asked to send to the officers of the Chicago Exposition, which will be held during July and August, 1921. Other points between Chicago and the Pacific coast, where masts will be needed, will be Omaha and Salt Lake City, and possibly others.

It is believed by the Department that the great stretches of territory embraced in this country make airships particularly adaptable as commercial carriers. To definitely establish this, numerous flights across the country wil be made by the ZR-2 as long as they do not interfere with the Naval activities of the ship.

Aerial Code Urged

At the ninth annual meeting of the Chamber of Commerce of the United States, which will be held at Atlantic City April 27-29, The National Aircraft Underwriters' Association will submit for consideration the following resolution:

"Whereas, the prevailing economic situation demands a reduction of government expenditures, an increase of business activity, and full opportunity for the development of our transportation facilities; and

"Whereas, the military and naval authorities concede that a strong aerial force is one of the surest and most economical means of national security, if there be built up a commercial aeronautical industry which will make available a reserve in production facilities and trained personnel; and

"Whereas, the development of aerial navigation as a means of transportation of cargo and passengers and as a civilian reserve to be drawn on in any national emergency is being retarded by the lack of regulatory federal legislation; and

"Whereas, public safety demands that the rights, duties, and liabilities of aircraft owners and operators shall be definitely and authoritatively determined; therefore, be it

"*Resolved* by the Chamber of Commerce of the United States of America, That Congress be urged to consider at once the aeronautical situation, and that it be requested to prepare and pass legislation embodying an aerial code and providing the necessary machinery for its enforcement; and be it further

"*Resolved,* That copies of the resolution be submitted to the presiding officers of the Senate and House of Representatives

The smallest and largest aeroplanes manufactured in Los Angeles. The Kinner "Airster", 26 ft. span, manufactured by the Kinner Airplane Corp., and the "Cloudster", 56 ft. span, manufactured by the Davis-Douglas Co.

and also to the members of the following committees in both chambers: Military, Naval, Post Office and Post Roads, Ways and Means, Finance, Appropriations and Judiciary."

Seeing Bryce Canyon by Aeroplane

One of the most interesting aerial excursions undertaken in the United States by a civilian flier is that which included the exploration of Bryce Canyon and the surrounding country made successfully during the summer of 1920 by Mr. Hal H. Bullen, president of the Utah Airplane Company.

Flying from Ely, Nevada, to St. George, Utah, Mr. Bullen performed in 14 hours a journey which by the usual method of rail and stage-coach requires four days. The object of the flight was to attend the dedication of Zion National Park, at which exercises Senator Reed Smoot and Director Stephen T. Mather, of the U. S. National Park Service, were among the prominent visitors.

Following the dedicatory exercises, Mr. Bullen made an extended flight over the region, selecting and establishing landing fields, spending the summer and up to the 15th of September in exploring from the air localities either inaccessible or requiring long and tedious travel by ground modes of transportation. For example, in a flight over the oil structures near the point where the Standard Oil Company recently began developments, Mr. Bullen made, in a flight of 25 to 30 miles, a journey which stretches to 350 miles by land.

Particularly interesting was the trip through Bryce Canyon and the Cave Lake and Virgin River country, a hazardous undertaking in a region without landing fields of any kind, but which was accomplished without a single mishap.

Mr. Bullen's machine was a Curtiss Oriole, with a 150 h.p. K-6 motor. This machine accomplished easily an elevation of 1600 feet fully loaded, and in his flights Mr. Bullen was accompanied usually by a mechanician and occasionally by a passenger, also.

A number of most attractive photographs were taken by Mr. Bullen showing the physical contour of the region, the beauty of the scenery, and the peculiar stratified structure and suggesting the rich and varied coloring that belongs to the volcanic formation of the locality.

During the coming summer Mr. Bullen plans a number of flights, in the same region, largely devoted to carrying scientific experts into inaccessible localities. Among the points to be explored are Henry Mountains and San Juan County, the Navajo Indian Reservation, the ruins of the Cliff Dwellers, Rainbow Natural Bridge, the Painted Desert, Zion National Park, Bryce Canyon, and the Virgin River Country.

Aeronautics at University of California

A course of special interest to any one following the subject of aeronautics is being offered by the Technical Department of the University of California.

A series of eight lectures will be given by Allan F. Bonnalie, as follows:

1. History of Flight—Development of the Glider—Application of Power—Types of Aeroplanes—Classification and Use—Trend of Design. Bibliography.
2. Development of the Aeroplane Engine—The Maxim and Langley Steam Engines—The Manly Gasoline Engine—The Wright Motor—Modern Development—Types and Stability.
3. Theory of Flight—Stability and Control—Air Flow—Wing Curves—Streamlined Bodies—Nomenclature.
4. Theory of the Internal Combustion Engine—The Cycle of Operations—Carburetion—Ignition.
5. Elements of Aeroplane Design. Wings—Fuselage—Control Surfaces—Under Carriage—Materials of Construction.
6. Design of the Engine—Cylinders and Their Arrangement—Cooling—Valves and Valve Gears—Bearings and Lubrication. Materials—Trend of Design.
7. Care and Maintenance of the Aeroplane Engine.
8. Practical Flying—Cross Country Flights—Prevention of Accidents. General Review.

The class will meet in the office of Walter T. Varney, distributor of Lincoln and Standard Bristol Aeroplanes, 832 Post Street, San Francisco, on Tuesdays from 7:15 to 9:15 P. M.

UNITED STATES POST OFFICE DEPARTMENT AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, February, 1921

DIVISION	Gasoline	Grease and Oil	Repairs and Accessories	Miscellaneous	Motorcycles, Trucks	Rent, Light, Fuel, Power, Telephone and Water	Office Force and Watchmen	Pilots	Mechanics and Helpers	Radio	Departmental Overhead Charge	Interest on Investment	TOTAL	SERVICE AND UNIT COST: Gallons of Gasoline	Total Time Run	Total Miles Run	Cost per Hour	Cost per Mile
															hr. min.			
New York-Washington..	$1,556.27	$332.98	$824.52	$1,325.45	$1,117.85	$672.29	$1,084.70	$1,393.12	$1,825.64	$284.68	$226.52	$448.75	$11,092.77	4,092	128 23	10,558	$86.40	$1.05
St. Louis-Twin Cities..	2,250.37	348.41	1,441.86	3,334.35	2,015.53	993.62	2,358.54	2,665.30	3,671.48	854.07	679.55	1,271.18	21,884.26	6,638	248 47	18,711	87.96	1.17
New York-Cleveland....	2,496.95	458.84	3,595.61	3,360.51	1,046.65	587.93	1,726.81	1,798.61	3,969.75	569.38	453.04	1,241.25	21,325.33	6,724	194 47	16,376	109.48	1.30
Cleveland-Chicago.....	2,159.33	335.61	369.82	3,187.49	406.54	460.66	1,209.90	1,730.94	835.86	427.03	339.78	225.00	11,687.96	5,886	175 33	15,352	66.58	.76
Chicago-Omaha......	2,157.41	480.64	2,134.46	1,869.10	328.17	375.44	1,179.25	1,886.66	2,499.22	569.38	453.04	912.50	14,845.27	6,128	164 42	15,359	90.13	.97
Omaha-Salt Lake....	4,966.97	1,323.22	6,228.83	3,467.18	638.99	449.75	2,340.76	3,575.07	2,737.52	1,186.20	943.82	562.50	28,420.81	14,443	438 03	37,088	64.88	.77
Salt Lake-San Francisco	3,236.40	544.48	3,094.31	3,900.52	1,028.18	365.13	2,125.45	3,197.04	2,848.90	854.07	679.55	725.00	22,599.03	9,375	382 49	30,211	59.03	.75
Totals and Averages...	$18,823.70	$3,824.18	$17,689.41	$20,464.60	$6,581.91	$3,904.82	$12,025.41	$16,246.74	$18,388.37	$4,744.81	$3,775.30	$5,386.18	$131,855.43	68,698	1,733 04	143,655	$76.08	$0.92

Planes operated on New York-Washington Division:
Curtiss R4's, equipped with Liberty 12 motors.
De Havilands, equipped with Liberty 12 motors.
Curtiss JN4D's, equipped with Curtiss OX5 motors. (Used for testing pilots.)

Planes operated on St. Louis-Twin Cities Division:
Standard, equipped with Hispano-Suiza motors.
Curtiss JN4H's, equipped with Hispano-Suiza motors.
Twin De Havilands, equipped with 2 Liberty 6 motors.
Junker (J. L. Larsen), equipped with B. M. W. motor.

Planes operated on New York-Cleveland Division:
Curtiss R4's, equipped with Liberty 12 motors.
De Havilands, equipped with 2 Liberty 12 motors.
Twin De Havilands, equipped with 2 Liberty 6 motors.
Curtiss HA's, equipped with Liberty 12 motors.

Planes operated on Cleveland-Chicago Division:
De Havilands, equipped with Liberty 12 motors.
Twin De Havilands, equipped with 2 Liberty 6 motors.
Martin, equipped with 2 Liberty 12 motors.
Curtiss HA's, equipped with Liberty 12 motor.

Planes operated on Chicago-Omaha Division:
De Havilands, equipped with Liberty 12 motors.
Twin De Havilands, equipped with 2 Liberty 6 motors.
Junkers (J. L. Larsen), equipped with B. M. W. motors.

Planes operated on Omaha-Salt Lake Division:
De Havilands, equipped with Liberty 12 motors.

Planes operated on Salt Lake-San Francisco Division:
De Havilands, equipped with Liberty 12 motors.

COST PER MILE

Division	Overhead	Flying	Maintenance
New York-Washington........	$0.32	$0.31	$0.38
St. Louis-Twin Cities...........	.44	.26	.45
New York-Cleveland...........	.34	.29	.67
Cleveland-Chicago..............	.20	.28	.28
Chicago-Omaha................	.25	.30	.42
Omaha-Salt Lake................	.17	.27	.33
Salt Lake-San Francisco.........	.19	.23	.33
Entire Service..................	$0.25	$0.27	$0.40

OTTO PRAEGER, Second Assistant Postmaster General.

Huff Daland Biplane

The Huff-Daland biplane arrived at Bolling Field, Washington, D. C., recently and was set up there for some experimental tests. This plane has a wing spread of 37 feet, stands 8½ feet high and has an overall length of 23 feet. Its weight loaded is 2,800 pounds, which includes gasoline for two hours and five men including the pilot. Its weight empty is approximately 1,750 pounds. It is equipped with two Anzani engines, totalling 200 h.p. Its gasoline capacity is 45 gallons, which is sufficient for 2½ hours' flight. Its speed is about 90 to 100 miles per hour at full throttle. Its overall factor of safety is about 6, and it takes off in about 8 seconds.

This plane is manufactured by the Huff-Daland Company, who have manufactured their model H.D.-4 as an army training plane for which a contract for three experimental models has been let and on which the sand and flight tests have been made. They have been examined and accepted. This plane is equipped with 140 h.p. 9-cylinder Lawrence radial motor. Mr. Huff states that the company has specific orders for five of these machines. The company owns the design patents, fuselage patents and variable camber wing patent, all of which they have developed. Mr. T. H. Huff, Mass. Institute of Technology, 1915, is the president of the company, and Mr. L. G. Randall is general manager. Mr. Huff was formerly with the Standard Aero Corporation, formerly located at Plainfield, New Jersey.

Mr. C. M. Devitalis is the pilot of the plane which is being tested at Washington. This particular plane is being tested with reference to picking up materials during flight from the ground in order to work out patents that are pending for the purpose of accomplishing this feat. The plane will be in action here for some little time in the process of conducting these tests. The plane has a high parasite resistance when being landed and consequently rolls but a short distance on landing. The plane has several unique features in its construction that will prove of interest in engineering circles.

Aluminum Tariff Opposed

Washington.—When the work of framing tariff legislation begins at the extra session of Congress, a spirited fight will be made by automobile and aeroplane manufacturers and other industries against the proposal to increase the tariff on aluminum. The entire supply in this country is controlled by the Aluminum Co. of America, which has made enormous profits in the last seven years. Manufacturers feel that if aluminum is not placed on the free list the present tariff of two cents a pound should be left undisturbed instead of being raised to seven cents, as the company is urging.

The Gallaudet News

We are in receipt of the first issue of *The Gallaudet News,* a journal devoted to the interest of the employees of the Gallaudet Aircraft Corporation. It is well put together and ought to be of definite value in developing the *esprit de corps* of this factory's employees.

Elias & Bro. Joins Manufacturers Aircraft Association

The Manufacturers' Aircraft Association announces that the firm of G. Elias & Bro., Inc., of Buffalo, N. Y., has acquired membership in the organization. This is the 21st aeroplane company to join the Association. Of this number 16 are still active.

The house of G. Elias & Bro. was established as a partnership in 1881 and continued so until 1914, when the business was incorporated with a capital of $500,000 and a surplus of $20,000. In 1919 they established an Aircraft Department and after two years of preliminary work, began the actual manufacture of areoplanes on contracts awarded them by the Army and Navy on their own designs.

In the first Army Competition for designs, held on May 24th, 1920, they were awarded one of two prizes of $3,000 for the best designed Training Plane. On the second Army Competition for designs of seven different types, they were awarded a prize of $4,500 for one of their designs.

In the Navy Competitions, in which some forty-five designs were submitted, on February 15th, 1921, theirs was one of the five designs accepted for final examination.

They are now building seven E. M. Expeditionary Type XIV Land and Sea Planes for the Navy and three Training Planes for the Army. They have a complete plant and make everything themselves required for the planes that they build. They have a staff of experienced men in every department and are ready to build planes to order for commercial purposes. Their plant at Buffalo occupies twenty acres, on which the factory buildings contain about 300,000 square feet of floor space. They have every facility for economic and rapid production.

The Officers of the Company are as follows: A. J. Elias, President; A. A. Nessler, Vice-President; J. A. Kreuser, Treasurer; L. J. Koch, Secretary; Max Stupar, Superintendent of Construction, and D. Earl Dunlap, Designing Engineer.

Air Service Bids

Machine Screws—Procurement Branch, Air Service, Munitions Bldg., Washington.—Bids are wanted until 2:30 p. m., April 25, circular 64, for furnishing large quantities of brass and iron machine screws. For information address above.

Emery and Crocus Cloth—Procurement Branch, Air Service, Munitions Bldg., Washington.—Bids are wanted until 2:30 p. m., April 22, circular 67, for furnishing 400 rolls crocus cloth and 43 reams emery cloth. For information address above.

Band Saws—Procurement Branch, Air Service, Munitions Bldg., Washington.—Bids are wanted until 2:30 p. m., April 28, circular 68, for furnishing 2,500 ft. band saws. For information address above.

Machine Bolts and Nuts—Procurement Branch, Air Service, Munitions Bldg., Washington.—Bids are wanted until 2:30 p. m., April 27, circular 66, for furnishing large quantities of machine bolts with nuts. For information address above.

Ferro Silicon and Caustic Soda—Air Service, Procurement Branch, Munitions Bldg., Washington.—Bids are wanted until April 29, circular 69, for 200,000 lbs. ferro silcon and 700,000 lbs. caustic soda. For information address above.

Balloon Cloth—Air Service, Procurement Branch, Munitions Bldg., Washington.—Bids are wanted until 2:30 p. m., April 21, circular 75, for furnishing 40,000 yards special balloon cloth. For information address above.

Oscillograph—Engineering Division, Air Service, McCook Field, Dayton.—Bids are wanted until April 26, circular 21-222, for furnishing 1 portable oscillograph. For information address above.

Sodium Hyposulphite—Procurement Branch, Air Service, Munitions Bldg., Washington.—Bids are wanted until April 29, circular 72, for furnishing 30,000 lbs. sodium hyposulphite. For information address above.

Testing Machines—Engineering Division, Air Service, McCook Field, Dayton, Ohio.—Bids are wanted until April 22, circular 21-219, for furnishing 4 fatigue testing machines. For information address above.

Observation Balloons—Air Service, Munitions Bldg., Washington.—Bids are wanted until 2:30 p. m., May 2, circular 71, for furnishing 4 observation balloons, type Ovorio-Prassone, capacity 37,500 cubic feet. For information address above.

Colonel Shaughnessy Appointed Second Assistant Postmaster General

(*Concluded from page* 154)

constantly displayed marked enthusiasm, originality and sound judgment.

In addition he was decorated by the President of the French Republic on September 24, 1919, with the Legion of Honor, Order of the Black Star, for distinguished service rendered to the French forces.

He was especially commended by the General Staff for conspicuous service during critical operations at Château-Thierry and also during the St. Mihiel and Meuse-Argonne offensives.

January 17, 1920, Colonel Shaughnessy was commissioned a full colonel in the Officers' Reserve Corps, Engineer Section, and was further honored in War Department G. O. No. 74, December 16, 1920, by being included in the initial General Staff eligible list, which is a selected group of officers who by virtue of meritorious service are declared to be competent for General Staff duty without taking the prescribed course of training that has been outlined as necessary as a result of the late war experience.

Colonel Shaughnessy returned to the United States September 26, 1919, resuming service with the Chicago & Northwestern Railway, resigning therefrom to become Assistant Director, Division of Transportation, of the American Petroleum Institute, where he is now located.

Colonel Shaughnessy is a member of the executive committee, Fidelity (New York Elks) Post No. 712, American Legion, is also member of the New York Post, Military Order of the World War, and member New York Post, Society American Military Engineers, member 13th Engineers Officers' Club, member American Association Railroad Superintendents.

THE FOKKER COMMERCIAL EXPRESS BIPLANE TYPE CII

TO anyone studying the needs of commercial aviation and the many uses the world has for aeroplanes at the present day, it invariably soon becomes apparent that there is a very decided place in the scheme of things for a small and handy 3-seater machine, in fact there is little doubt that its general sphere of usefulness is, at the present stage of aviation, more extended than that of any other type.

Even in the operation of air lines normally using big planes, carrying anything over 1000 lbs. paying load, it has been found very advantageous to have some smaller and faster machines, carrying approximately half as much, available for "rush jobs," such as fetching in passengers from places off the main route or taking officials from field to field at any time, as well as for taking the place of the bigger machine on a schedule trip, when the paying load is small and time and expense may be saved by using the smaller machines.

For what may be called "irregular air transport," such as aerial taxi and hire work, private and business use, it is in many cases the 3-seater which fills the bill.

It is for these purposes that the Fokker C II is intended and has proved eminently suitable.

A glance at the machine shows the family likeness to the famous D VII, which was probably the most redoubtable and successful fighting plane of the war. While of slightly bigger dimensions than the D VII, the C II shows the same rugged construction, which stands up to the terrific dives for which the D VII is noted, the same absence of bracing wires and the same simplicity of construction, which make constant attention and skilled riggers unnecessary, the same use of everyday materials throughout the machine, which make for easy repair in the field. The flying qualities of the C II are equally good, the machine being extremely manueverable, light on the controls, and remaining completely controllable at the very lowest speeds.

The *Engine* is a 185 H.P. B.M.W., a very reliable and simple 6 cylinder, which is noted for its low gas consumption (10 gallons per hour) and its constant power output of any altitude, which makes it particularly suitable for high flying over mountainous country.

The *Engine mounting,* like the rest of the fuselage, is entirely carried out in steel tube and so arranged that the engine is completely and easily accessible on all sides by removing as much of the quick detachable cowling as is necessary. By this means the labor cost and time involved in making small adjustments, or even removing the engine, is reduced to a minimum. Every detail of this part of the machine being of metal, there is nothing inflammable and nothing which deteriorates through soaking in oil or through heat, anywhere near the engine.

The V fronted *Radiator* makes a nice nose to the machine and fits in well with the cowling.

The 9'3" diameter *Propeller* is fixed on the boss with one big nut and a cone piece, instead of the usual bolts, so that changing it is a very quick operation and bad alignment through unequal tightening-up impossible.

One of the striking features of the Fokker C II is the position of the *Gasoline Tank,* which is mounted in the chassis, just above the axle and the cross number, for which it forms a fairing.

This arrangement removes the occupants of the machine from all danger of fire, which, although no Fokker machine has been known to catch fire in the air, is regarded by many as one of the only sources of danger left in flying. Practical tests have conclusively proved that, even if this tank is shot on fire during flight, the flames do not touch the rest of the machine and the gasoline burns out, after which a normal descent is made. Thousands of hours of flying under all sorts of conditions, with the Fokker 2-seater fighting planes of the Netherlands Army, have shown up no disadvantages in this placing of the tank and troubles with the gasoline system in general have been remarkably few. The tank is divided into a reserve and main tank containing over 10 and 30 gallons respectively, sufficient for 4 hours at full throttle giving a range of 450 miles. The gasoline is forced up to the carburetor bv pressure, provided by a pump on the motor, and an auxiliary hand pump. All pipes are carefully secured against vibration and fitted with flexible joints wherever necessary.

The *Fuselage* is constructed on the usual Fokker system, of steel tube, which has proved so successful in the thousands of machines used in the war. It is remarkably strong, very durable and easily repaired in case of damage, by methods obvious to any mechanic.

The *Chassis* is of the V type, particularly strongly made of streamline steel tube and fixed to the fuselage by simple ball and socket joints. The axle is rubber sprung.

The *Pilot's cockpit* is behind the engine compartment and the pilot is so placed that he has a very good view both forward and for landing, owing to the reduced chord of the lower wings.

The *Controls* are of the joy-stick and rudder bar type; the joy-stick is fitted with a double grip handle of which one side controls the throttle. There is also a set of throttle controls fixed on the pilot's left at the side of the cockpit, so that either control can be used at the same time. The necessary instruments are fitted in the dash and the hand pump at a convenient angle, on the pilot's right.

The *Passengers' cabin* is behind the pilot, its top forming practically one streamline with the wind screen and the pilot's head. It contains seats for 2 passengers, arranged staggered, so that both have shoulder room. Entrance is through a good sized door in the left hand side, while the windows are very big and can be left out in hot weather. The cabin being behind the wings, a perfect view of the ground is obtained.

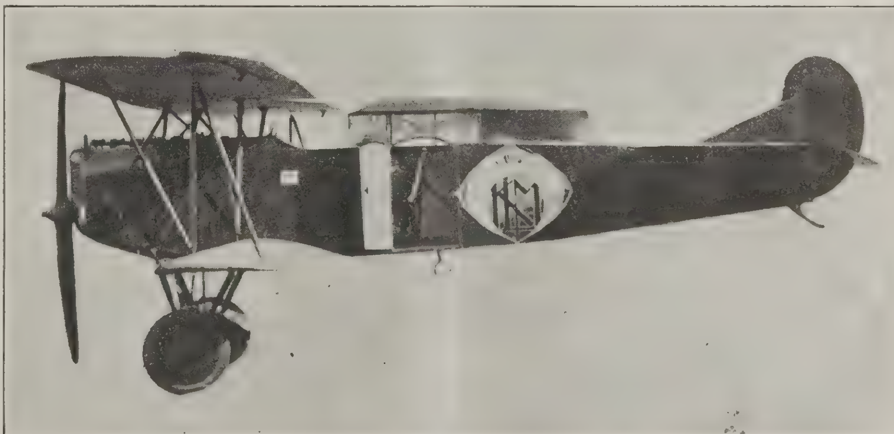
The *Tail Plane, Elevators, Fin and Rudder* are all entirely of steel tube construction, painted, tape wrapped, linen covered, doped and varnished. The tail plane is triangular in shape; the front cross tube is rigidly fixed across the fuselage and the rear edge is supported by 2 diagonal stay tubes, running to the bottom end of the stern post. The rudder and fin are braced to the tail plane by one wire on each side. The elevators and the rudder are balanced and control cables are duplicated.

The *Tail Skid* is of ash, well sprung and high enough to properly protect the rudder.

The *Planes* are of the Cantilever type, completely free of external bracing wires, thus permitting very easy and quick erection and dismantling. As in the case with all Fokker machines, setting up the wings is such a quick and simple operation it is practically impossible to make mistakes; there is no trueing-up or other delicate adjustment, so that highly skilled riggers are unnecessary. The top wing, which is one piece and has both a greater span and chord than the lower, has the front spar mounted by 2 bolts on 2 tripods of steel tube, projecting rigidly from either side of the fuselage, which completely prevents any movement of the whole wing system, either sideways or fore and aft. The back spar is braced to the fuselage by a ball jointed diagonal strut on either side. The bottom wing, also in one piece, fits into a gap in the bottom of the fuselage and is rigidly fixed by 4 bolts. The upper and lower wings are joined near the tip by a one-piece N shaped steel strut. The wings are built up with very strong and deep box section spars of three ply and spruce, solid three ply ribs and a bent three ply leading edge; they are linen covered, doped and varnished. The minimum factor of safety on the structure is 8.

General Specifications

Span over all	34 ft. 9 in.
Length over all	23 ft. 8 in.
Height over all	9 ft. 5 in.
Wing area	290 sq. ft.
Weight empty	1,820 lbs.
Weight loaded	2,600 lbs.
Maximum speed	115 m.p.h.
Landing speed	45 m.p.h.
Climb	3,300 ft. in 5 min.
	10,000 ft. in 14 min.
Radius of action	4 hours, 450 miles
Fuel consumption per hour:	
Gasoline or Benzole	9-10 gals.
Oil	1 gal.



The Fokker CII Commercial three-seater, with 185 H.P., B.M.W. motor

THE RESISTANCE OF AEROFOILS

By W. F. GERHARDT

Aeronautical Engineer, McCook Field

THE following discussion of the properties of aerofoils is an attempt to present the most important matters treated by Dr. de Bothezat in his Aerofoil Memoir.[1] That paper is a rigorous treatment of fluid resistance as it is met in studying aerofoils and is certainly the most comprehensive work published on that subject. One of its most valuable features for the engineer is the set of definitions of the fundamental elements which are very clearly stated and interrelated. It is hard to overestimate the importance of a work which provides such an adequate basis for the right understanding of the problem.

Its unique achievement is the correlation, by the empirical theoretical method adopted, of the deepest theoretical developments with reality, giving conclusions which must find practical application in research and design. It is of especial interest to note that he has developed, independently and about the same time as Professor Prandtl, the parabolic law for the variation of induced drag, a generalization which has special importance and value in airplane performance and stability. It is no doubt the clear understanding of the *physical nature of the phenomena* which allows Dr. de Bothezat to make such powerful use of his mathematical methods.

The writer feels that attention should also be called to other writings by the same author; on airplane performance, blade screws, and stability. An examination of these works reveals the fact that Dr. de Bothezat has not only treated the whole field of the applications of dynamics to aviation but has also evolved a "General Theory" for each branch. In his "Steady Motion Theory,"[2] he has set up general and workable equations of motion for the airplane, the propeller, the motor, and the motor-propeller set, from which all the conclusions, necessary for performance prediction and design, can be drawn. In the Blade Screw Paper[3], he has for the first time given a complete general analysis of the screw phenomenon, predicting analytically all the *sixteen states of work of a Blade Screw.* By the aid of general relations any problem in the domain of Blade Screws can be solved. For example, the designing formulas for Helicopter Screws follow by simple discussion of the fundamental relations. The chart therein printed giving the thrust per horsepower of helicopter screws for average efficiencies predicts the lifting performance now being attained by experimental machines in various parts of the world. The stability work is perhaps of even greater scale, considering the early date of its completion. Dr. de Bothezat has here solved the problem in the real engineering way; he has expressed the equations of motion explicitly in terms of the dimensions and characteristics of the stabilizing organs, has discussed the relations in their generality, (not merely making numerical substitutions and calculations on a single case) and drawn general conclusions. The quantitative relations between the stability characteristics and the characteristics of the stabilizing organs, make possible for the first time the *designing for stability.* This in 1911.

As a result there is presented to the engineer a self consistent system of Aeronautical Engineering, which by reason of the accuracy and unity of treatment furnishes a basis for the most serious aerodynamical investigation and design. The scale of such work can only be appreciated after long study.

The first two chapters of the Aerofoil Paper will be presented quite fully, the third chapter will be summarized. Additions and special interpretations are done at the responsibility of the writer.

Major Bane, Chief of McCook Field, has offered his personal encouragement to this attempt to present to the busy Aeronautical Engineer, the latest developments in the Field.

The motion of terrestrial bodies always takes place in a fluid, most frequently in air or water.

When the velocity of the body is relatively low and the fluid of low density and viscosity, the influence of the fluid on the motion of the body is not very marked. In such cases, a very small error is entailed by neglecting the influence of the medium and considering that the motion takes place in a vacuum. This is exactly what is done in the study of most kinematical and dynamical problems. In the design of gears, flywheels, street cars, and low-speed automobiles, the air resistance is neglected.

When, however, the velocity of the body reaches a certain value in a viscious fluid of finite density, the action of the fluid in modifying the motion of the body becomes of great importance. In such cases, to be able to study the motion of the body, we must add to the other forces which act on the body, a system of forces which express the action of the fluid on the different elements of the surface of the body. This system of superficial forces is called the *fluid resistance.* The aeroplane is the classical, but by no means the only example of these cases, as the designer of racing automobiles, passenger locomotives, etc., would agree. The distinguishing feature of the heavier than air craft is that the air-resistance is the *basic* phenomenon.

The determination of the fluid resistance of any body, having any general motion in a fluid, is so complex a problem that its general solution cannot be found either experimentally or theoretically. Only some simple cases of uniform rectilinear motion have been subjected to more or less complete investigation.

The General Nature of Fluid Resistance

Consider any solid body brought into motion with a rectilinear and uniform velocity of translation in the air, which is considered to be immobile with reference to the earth, to have a uniform and constant temperature, and to be of such dimensions that the disturbance created does not reach the boundaries of the fluid.

A certain time after the body has attained this constant velocity, certain steady conditions are established; the body is accompanied in its motion by a certain state of disturbance of the fluid around it. In general, the disturbance is invariable in front of the body. In the rear, however, the disturbance is *invariable* only when the velocity of the body is low, most generally it is there *periodical.*

It is customary in aerodynamical discussions to consider the motion of a body through an immobile medium identical with the motion of the fluid past an immobile body, provided the relative velocities are the same. It must be remembered, however, that when the boundaries of the fluid are close to the body (as is the case in many tunnel experiments) the influence exerted is by no means the same in both cases. The assumption that is made in accepting tunnel results is that the walls are so far from the model that their influence is negligible. In the following discussion, the two cases are assumed identical.

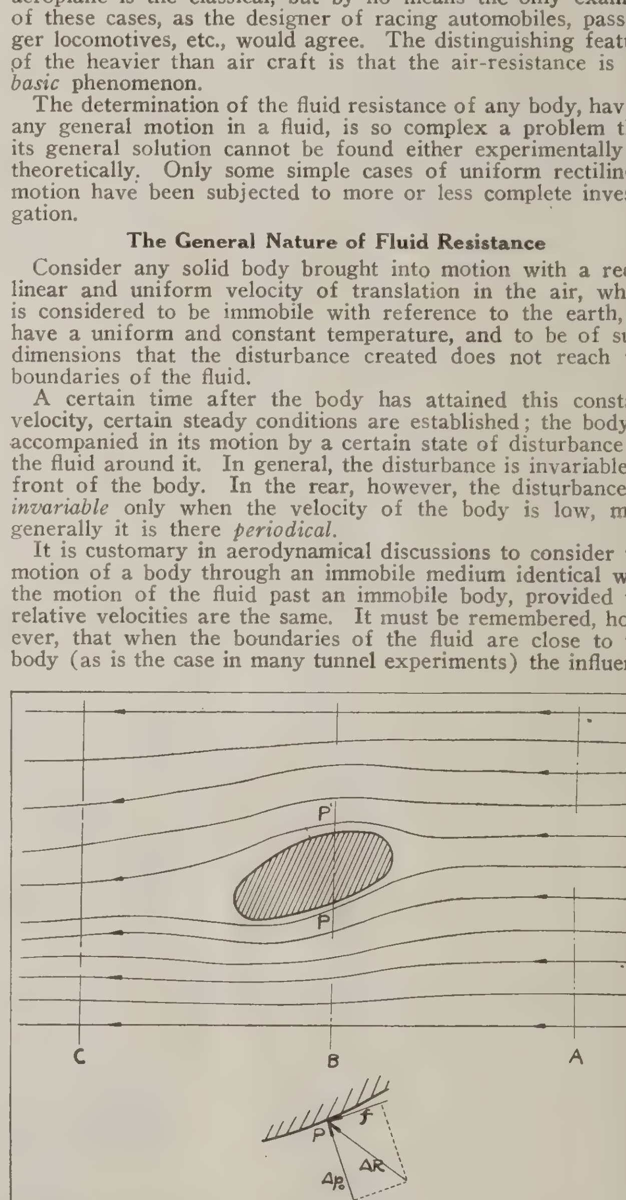


FIG. 1 – PRELIMINARY SCHEME OF THE FLUID RESISTANCE.

Let us consider the above mentioned body (Figure 1) moving in a fluid stream with velocity. V_0. The stream, therefore runs against it with the velocity and direction, V_0. For the simplicity of discussion we will consider first merely a thin "slice" of the body cut by two planes parallel to the direction of motion, one of which gives the cross section shown,

[1] "Introduction to the Laws of Air Resistance of Aerofoils"—by Dr. G. de Bothezat, N.A.C.A. 1918.

[2] "The General Theory of the Steady Motion of the Airplane," by Dr. G. de Bothezat, N.A.C.A. (in press)

[3] "The General Theory of Blade Screws," by Dr. G. de Bothezat, N.A.C.A. 1918.

[4] "L'Etude de la Stabilité de l'Aeroplane," by Dr. G. de Bithezat, Dunot et Pinad, Paris, 1911.

What is said of this "slice" applies qualitatively to every other, and in sum to the whole body.

At a section of the fluid stream sufficiently far in front of the body (Section A) the velocity and pressure are constant. The disturbance which the body produces, alters the values of the pressure and velocity in the vicinity of the body, and at Section B, for example, is observed a non-uniform distribution of velocities and pressures throughout that section.

The air impinges on the exposed surface of the body, at P for example, and creates the increase of pressure Δp. On the far side, as a p^1, the tendency for the air particles to pull away from the surface of the body reduces the pressure by the amount $\Delta^1 p$. The pressure p_0 acting from all sides does not affect the motion of the body, but Δp and $\Delta^1 p$ can be considered as external pushes and pulls.

Superposed on the forces of pressure are the forces of viscosity. The fluid mass close to the body experiences a resistance to sliding along the surface which is analogous to the friction between two solid bodies, and is called skin friction.

At any small element of the body, as P (Fig. 1). The force Δp, normal to the surface, and the froce f, tangential, can be replaced by a resultant ΔR acting askew to the surface.

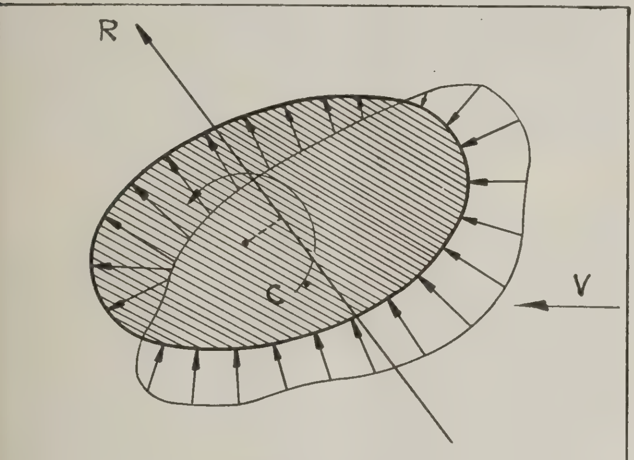


FIG. 2 – THE RESULTANT OF THE SYSTEM OF FORCES OF AIR RESISTANCE

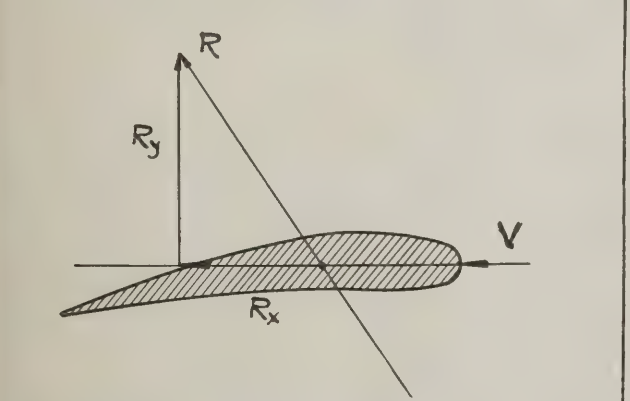


FIG. 3 – THE LIFT AND DRAG COMPONENTS

The same is true of every other element of the "slice" considered and for every other slice of the body. We may say, therefore, that there acts all over the surface of the body a system of superficial forces.

In Fig. 2 have been represented the probable system of forces acting on the slice of the body taken as example. The line drawn through the ends of the vectors in the graph of the variation of the force distribution over the whole surface.

This system of forces can always be reduced to a resultant force R and a resultant torque C. When the body has a plane of symmetry parallel to the velocity, the resistance of the fluid can be reduced to a unique resultant force R, acting in that plane, the projection of which on the direction of the velocity is in the inverse sense of the velocity. This is the usual case, with the aeroplane wing for example, and will be assumed in the remaining discussion unless otherwise stated.

It has been observed that in some cases for the same body brought into motion with the same velocity, the system of air resistance forces may be different depending on the manner in which it is brought to that state of motion. This is true of some struts and some thick aerofoils. But ordinarily, the same disturbance is established when the same body reaches the same velocity in the same fluid medium: *"There is a determinate fluid resistance for every solid body moving with a constant velocity in the same fluid medium."*

It must be remembered that the force R replaces the system of superficial forces only in the sense that the resulting motion is the same in both cases. In other senses the resultant is not equivalent to the system; for example, the stresses induced in the body are entirely different in the two cases. The resultant force and torque are the result only of an analytical

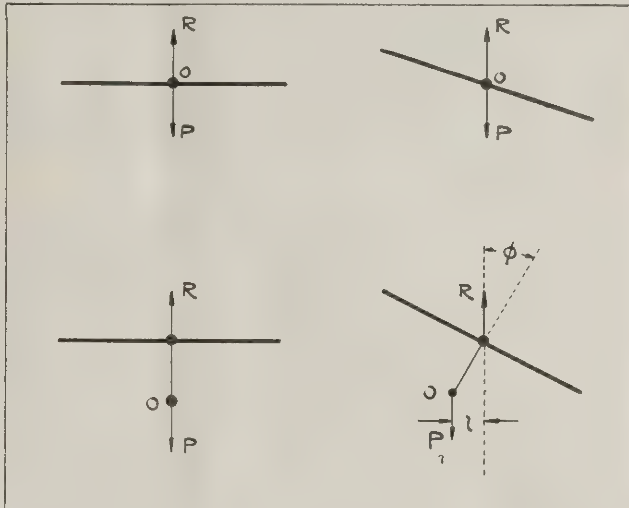


FIG. 4 – THE FALLACY OF THE LOW CENTER OF GRAVITY.

transformation, the possibility of which is established by the theorems of mechanics and which allows us to reduce a system of forces to its simplest expression.

A very common fallacy concerning the resultant force is that it has a point of application. In the early days of aviation, many people thought that the lift on the wings of an airplane acted as if it were a string attached to the middle of the wing somewhere within the aerofoil section, and held aloft by some unseen hand. (Fig. 3.) If the center of gravity were high the airplane would oscillate freely about this point (a and b) if the center of gravity were low it would tend to make the plane stable; to cause it to swing back to normal as does a pendulum (c and d).

The fallacy is, of course, that for such a condition the line of action of the resultant force R must swing out of the plane of symmetry by the angle of roll Φ. This error is possible solely by thinking in terms of a point of application.

By the principle of resolution of forces, the force R can be resolved into two forces, one perpendicular, Ry, and one parallel Rx, to the direction of motion (Fig. 4). The ratio Ry/Rx varies widely with the form of the body and its orientation toward the velocity. When the form of the body is such that for one orientation of the body toward the fluid stream this ratio is large, say 10 to 20, it is called an aerofoil, and is suitable as an aeroplane wing.

FIG 5 – PRESSURE DISTRIBUTION OVER AN AEROFOIL

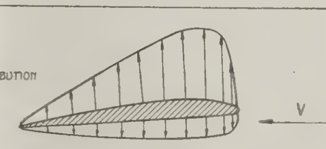
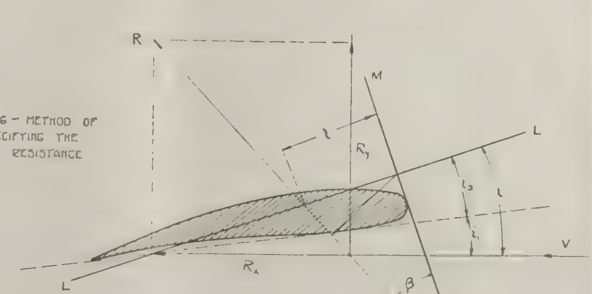


FIG 6 – METHOD OF SPECIFYING THE AIR RESISTANCE



Turning our attention to Section C of the fluid stream, we observe another feature of the disturbance caused by the body. There is a deflection of the stream behind the body. This deflection is in a sense opposite to the sense of the force Ry. It is a measure of the change of momentum in the fluid stream perpendicular to the velocity, which change of momentum is a necessary condition that a force Ry exist.

The usual form of an aerofoil is rectangular in plan with a section formed by a series of tangent arcs. It has a plane of symmetry, in which the resultant air reaction always lies.

The distribution of the air forces represented in general in Fig. 2 has a special conformation for the aerofoil. In Fig. 5 the pressure distribution for a conventional profile at a normal flight angle is shown. For other orientations of the aerofoil the force system varies in distribution and magnitude. It is at once evident that the sum of the negative pressure differences above is greater than the sum of the positive differences below, from which we see than an airplane is not so much *pushed,* as *sucked* into the air.

The next problem is to fully specify the resultant force R, for all the conditions in which the aerofoil is put.

The *"Laws of Air Resistance"* are *those formulas which give the magnitude and position of the resultant air force and torque in function of the form and dimensions of the body, the velocity of the fluid stream and the orientation of the body toward the stream.*

The Law of Air Resistance of Aerofoils

In order to fully specify the air resistance R it is necessary to determine; (1) the magnitude, (2) the orientation toward the aerofoil, (3) the position with reference to the aerofoil.

The determination of these quantities, as well as the orientation of the velocity toward the aerofoil which corresponds to a set of the above relations, requires the selection of suitable reference lines. It is convenient to choose two lines, LL and MM, mutually perpendicular and invariably connected to the aerofoil cross-section (Fig. 6).

The magnitude of the air reaction can be designated by the length of the vector R according to some convenient scale, or by suitable mathematical relations. Its orientation is denoted by the β angle includes between R and MM. Its position is fixed by the point C where R cuts LL; that is, by the distance ζ between MM and C. The orientation of the aerofoil toward the relative velocity is designated by the angle i included between the line LL and V. This is called the "angle of attack" or "angle of incidence."

It has been demonstrated by numerous experiments that the resultant air resistance encountered by the aerofoil, within certain limits of velocity variation follows the folowing empirical rules:

(A) The magnitude of R is

1. Proportional to the area of the aerofoil, A.
2. Proportional to the square of the velocity, V.
3. Proportional to the density of the air, δ.
4. A function of the angle of attack, i.

(B) The orientation and position of R are independent of the velocity, and are complex functions only of the orientation of the aerofoil toward the relative velocity.

In mathematical form (A) may be written:

$$(1)\qquad R=k\delta AV^2f_1(i) = k_1\delta AV^2$$

where k_1 is a function of the angle of attack only. Fact (B) can only be written:

$$(2)\qquad e=f_2(i)$$

It is convenient in Aerodynamics, as has been stated, to consider the components R_y and R_x of the air resistance R, that is, the drag and the lift. If these components are known, both the orientation and the magnitude of R are determined.

$$(3)\qquad R_x=R\sin(\beta+i) = k_1\sin(\beta+i)\,\delta AV^2 = k_x\,\delta AV^2$$

$$(4)\qquad R_y=R\cos(\beta+i) = k_1\cos(\beta+i)\,\delta AV^2 = k_y\,\delta AV^2$$

where the coefficient k_x, k_y are functions only of the angle i.

Since the relation between k_x, k_y, e and the angle of attack i are very complex, the determination of these relations is a matter of experimentation. This is a simple matter with the aid of a wind tunnel, in which a particular aerofoil is placed, subject to a wind current of constant velocity and density. The R_x and R_x are measured under different angles of attack.

$$(5)\qquad k_x=\frac{R_x}{\delta AV^2} \qquad k_y=\frac{R_y}{\delta AV^2}$$

Relations (2), (3) and (4) are the fundamental formulae of aerodynamics and constitute the experimental basis of most investigations in the field.

It should be unnecessary to point out that these relations should be expressed in a system of consistent units. Some one has, however, unwisely started—and we have unfortunately perpetuated—the inconsistent idea of using for density pounds per cubic foot; area, square feet; but for *velocity miles per hour. This is a mathematical illiteracy which should be openly confessed and persistently fought while there is yet time to correct the error.* The inconvenience and waste of time in carrying along the superfluous constants is alone sufficient reason to condemn this practice.

(To be continued)

COLONEL SHAUGHNESSY APPOINTED SECOND ASSISTANT POSTMASTER GENERAL

Colonel E. H. Shaughnessy, appointed by President Harding as Second Assistant Postmaster General, is a transportation expert. He has always resided in Chicago with the exception of several years spent at smaller cities in Illinois in connection with railway work. He entered the service of the Chicago & Northwestern Railway in July, 1899, as a telegrapher and remained continuously in the service of that railroad until May 28, 1917, when leave of absence was granted to enter the military service. During his connection with this railroad system he was promoted and served in many operating capacities, being last engaged as its trainmaster with office at Chicago.

During the month of May, 1917, the War Department called on the railroads entering Chicago quickly to mobilize a regiment of railwaymen for urgent service with the French forces. The railroads acted immediately for volunteers. Colonel Shaughnessy applied for service in any capacity. He was immediately relieved from railroad duties and asked to assist Colonel Langfitt, afterwards Major General Langfitt, in recruiting the regiment which afterwards became the 13th Engineers. Colonel Shaughnessy worked as a civilian in this capacity until May 28, 1917, when he was commissioned as a first lieutenant and immediately assumed command of Company "E," retaining command as first lieutenant and as captain until June 28, 1918.

The 13th Engineers sailed from the United States July 27th, hurried through England and France and after a short period of training were attached to the Second French Army, relieving the 7th French engineers, taking over the operation of an extremely important network of military railroad in the Verdun sector. The regimen tremained in the Verdun sector until well after the armistice, being one of the very few units that remained under French command during the entire time.

Upon arrival in the Verdun sector, Colonel Shaughnessy was made Railway Executive Officer in Charge of Railway Operation, remaining on this assignment until June 28, 1918, when, upon request of General W. W. Atterbury, he was detached from the regiment and assigned to duty with the Transportation Corps of the A. E. F., serving successively as General Superintendent, Assistant General Manager, General Manager and Acting Deputy Director General of Transportation, of the Advance Section (the active front), during this time being advanced in rank to Major on September 7, 1918, and lieutenant-colonel February 26, 1919. During this period at the beginning of the organization of the transportation corps in France Colonel Shaughnessy, in collaboration with French military and civilian railwaymen, prepared a joint French-English book of rules for railway operation which was used by the American forces during the entire period of hostilities and afterwards which proved to be of invaluable assistance in overcoming the great difficulties experienced in utilizing railwaymen in joint railroad operation who had no common language.

For service in France Colonel Shaughnessy was awarded the Distinguished Service Medal with the following citation (War Department, G. O. No. 95, July 26, 1919):

> Edward Henry Shaughnessy, Lieutenant Colonel, Transportation Corps, United States Army. For exceptionally meritorious and distinguished services. Serving successively as General Superintendent, General Manager and Acting Deputy Director General of Transportation, by his energy, zeal, and able management he rendered services of the highest type to the Transportation Corps of the American Expeditionary Forces. In the performance of his manifold duties he

(*Continued on page* 150)

RADIO COMMUNICATION WITH POSTAL AEROPLANES

By J. L. BERNARD and L. E. WHITTEMORE

(*Continued from page* 139)

15. Determining Absolute Direction

By coupling a trailing wire antenna with the tail coil, it is possible to secure unidirectional effects which are desirable in aircraft direction finding. It has been found that a trailing wire antenna about 100 ft. long with a heavy weight attached to the end, extends almost vertically downward from the pane and exhibits no directional properties. The procedure is simply to take a bearing with the two systems coupled to the proper degree and when a determination has been made of the absolute direction of the transmitting station from the ship, the coupling of the coil aerial to the antenna is made zero and bearings of greater accuracy can then be made with the coil alone. However, up to this time this method of absolute direction finding has not been employed over distances greater than 75 miles due to the fact that the apparatus is complicated and a balance between the compensating coil and radio receiving system for the elimination of induction is not possible when the antenna is coupled to the circuit.

The system must be calibrated but this occupies but a very short time and was usually made on leaving the field when a visual observation could be made on the transmitting station. The diagram of connections is given in Fig. 13.

16. Throttling Engines

It is not a practical proposition to throttle the engines below 1400 r.p.m. on the Martin Mail Plane, and for this reason throttling while in flight for the purpose of reducing acoustic disturbances has not been practised, but observations in this connection show that it requires a speed of less than 1000 r.p.m. to be of any value. Reports from those assigned to the development of direction finding on single-engine aeroplanes seem to indicate that there is some increase in the distance which can be covered satisfactorily by radio direction finding by throttling the engines to about 1000 r.p.m., after which the ship is brought down to a slight glide while observations on the position of the transmitting station are being made.

17. Radio-Frequency Choke Coils

Radio-frequency choke coils placed in series with the twelve spark plugs of a Standard Liberty Motor in an attempt to offer high impedance to the currents of the wave length of the high tension system and therefore cut down their amplitude to a value where it will not interfere with radio communication proved to be of absolutely no value.

IV. Localized Signal for Location of Landing Field

The ordinary methods of radio direction finding referred to above are sufficient to enable the pilot to come within about half a mile of the landing field. The pilot on the aeroplane can therefore use his radio direction finder only to find his way to the general vicinity of the field and not to the exact spot on which it is safe for him to land. It is desirable as well that there be located on the landing field a directive transmitting set which will provide signals by which the pilot may determine the exact location of his landing field and thereby descend to it in safety in time of fog or at night.

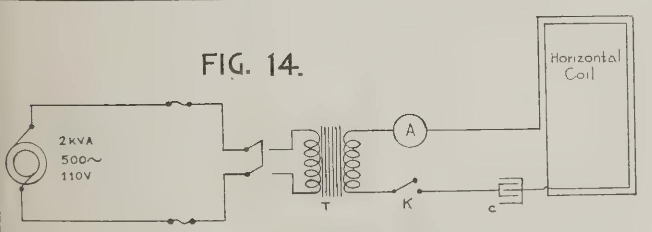
The experiments here described were conducted by the Bureau of Standards in co-operation with the Post Office Department during 1918 and 1919, having been begun by Mr. F. A. Kolster and others of the Bureau of Standards.

1. Low-Frequency Induction Signals

For the purpose of obtaining a localized signal which is strong in the immediate vicinity of the landing field and in the region directly above it but which decreases very rapidly with the distance from the field, it was decided to undertake experiments with alternating current of relatively low frequencies. Since the generators which are commercially supplied for radio transmitting sets have a frequency of 500 cycles it was decided to use this frequency for the first experiments. It was proposed to generate an alternating current in a coil placed horizontally either on a building or on the ground and receive signals on the plane by means of the mutual induction between this coil and a secondary coil wound horizontally on the lower wing of the aeroplane.

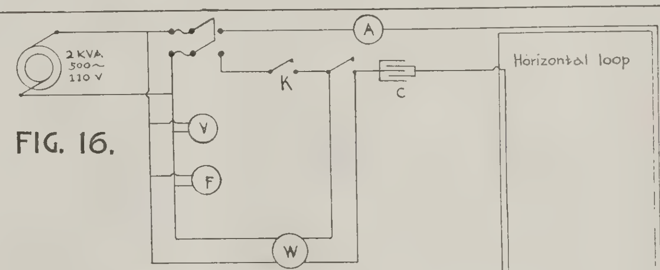
A transmitting coil of six turns, 42 x 160 ft., of No. 12 copper weatherproof wire was wound on the roof of the radio building at the Bureau of Standards. Twenty-four amperes of 500-cycle current were obtained in this coil by the use of the circuit shown in Fig. 14. A 6-turn coil was connected in series with the secondary of a transformer, T, and a mica condenser, C, having a capacity of 15 microfarads. The receiving circuit consisted of 40 turns of No. 20 cotton covered copper wire on the lower wings of a type JN-4, aerial No. 74, Curtis aeroplane. A flight was made over the Radio Building of the Bureau of Standards and signals were heard (using a special audio-frequency amplifier made at the Bureau of Standards) at a height of 3,000 ft. when the engine was running full speed,

FIG. 14.



C- Mica condenser, variable by 1uf steps from 1 to 13 μf

FIG. 16.



C - Mica Condenser, Variable by 1 μf Steps from 1 to 13 μf.

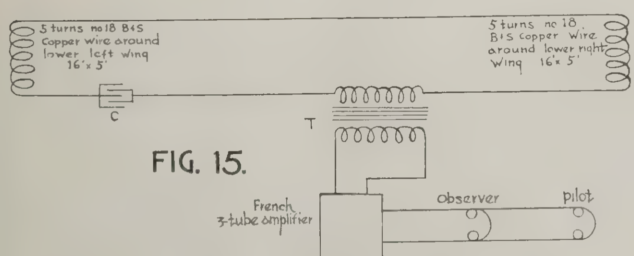


FIG. 15.

C-paper condesers, 0-23 μf by 0.1 mf steps
T-Amplifier Input transformer

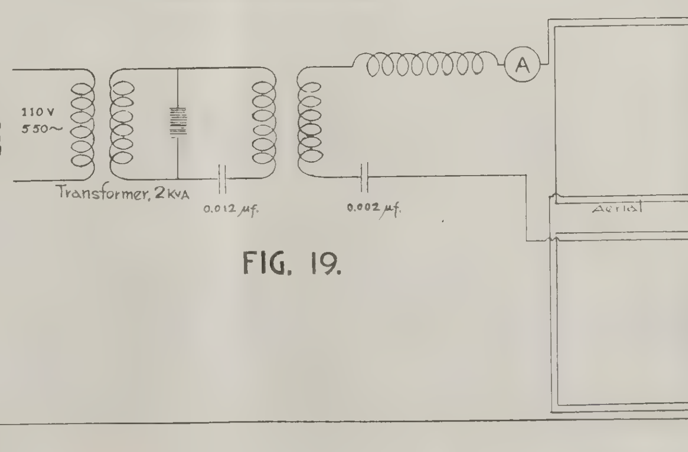


FIG. 19.

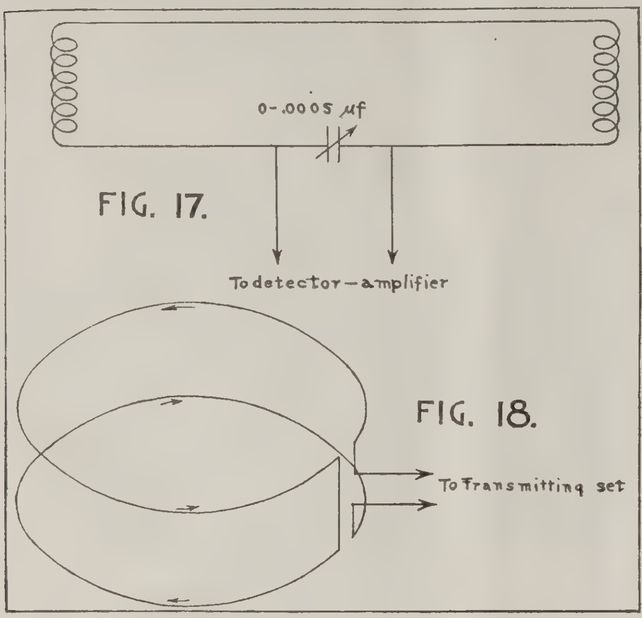


FIG. 17.

FIG. 18.

though the duration of the signals was not more than five seconds. The receiving circuit was that shown in Fig. 15.

In order to carry on tests under the actual field conditions it was decided to move the transmitting apparatus to the Aviation Field, College Park, Md. A 2 kw. gasoline engine driving a 500-cycle generator was secured from the Navy Department for use as a source of power for this station. A coil 600 x 800 feet, having only a single turn, was laid on the ground around the part of the landing field not used by the planes. Five turns of No. 18 single cotton covered wire were wound on each half of the lower wing of a new Curtiss type R aeroplane, and a French three-step amplifier was substituted for the audio-frequency amplifier previously used.

Using this apparatus good signals were heard for about seven seconds during horizontal flight over the field, at an altitude of 1,500 feet with the engine running full speed. Signals were heard for longer times at lower altitudes, namely, eight seconds at 1,000 feet, ten seconds at 500 feet, and eighteen seconds at 200 feet. The plane was flying at approximately 90 miles per hour. The area over which these signals are audible is too small for practical service and it was decided to construct a larger loop for future work.

A single turn of No. 12 and No. 10 rubber-covered wire was laid out around the edge of the landing field, which included an area approximately 1,500 x 2,000 feet. Using a seven-tube British amplifier and a Curtiss type R plane with the coils described above, signals were heard at 1,500 to 2,000 feet and over an area much greater than above. This area was almost large enough for the plane to circle around the field and remain continually where the signals could be heard.

Several possible improvements could be made in the apparatus in order to obtain louder signals on the aeroplanes. First, it was found that the transmitting circuit was not resonant to 500 cycles. This was remedied by the use of the circuit as shown in Fig. 16. The current in the transmitting loop was thereby increased from 12 amperes to 26 amperes, it having been found that a capacity of 10 uf. was necessary to tune the circuit to the frequency of the generator. Second, a study was made of the receiving circuit and several types of amplifier transformers were experimented with in an effort to obtain sharper tuning and louder signals in the receiving circuit. It was found that a transformer having a high ratio of transformation (about 100 to 1) and a condenser of 14 uf. were satisfactory. However, these improvements did not result in signals at any greater heights than those previously obtained. This was possibly due to defective insulation of the transmitting coil though the resistance of this coil was found to be 5.25 ohms and the insulation resistance of ground 10,400 ohms.

Subsequently, arrangements were made to produce 1,000-cycle current in the large single turn loop and test flights were conducted to compare the 1,000-cycle signal with the 500-cycle signal. The results seemed to indicate that there was very little difference between the signals obtained in the two cases. However, when a very quiet engine was used, such as on the type JN plane, signals were heard using 20 amperes of 1,000-cycle current in the transmitting circuit when the plane was at a height of 6,000 feet. It is possible that a faulty tuning in the secondary or receiving circuit may be partly responsible for this. This is difficult to determine since the resonance is very broad when as large a capacity is used as was required in this case.

2. Radio-Frequency Signals

A trial was also made of radio-frequency currents in order to determine whether it might be possible to use the same wave length for the landing signals as for the radio direction finding. Two-five amperes were obtained in the single-turn 7,000 ft. coil at a wave length of 1,500 meters. Horizontal coils were used for receiving and the circuit tuned to 1,500 meters as shown in Fig. 17. However, it was found that signals could be heard only within fifty feet of the wire on the ground. Undoubtedly, the large capacity of the transmitting coil to the ground had some effect on the current distribution in this loop.

It was then proposed that a radio transmitting aerial be constructed which should be circular in form as though a vertical single-turn coil were bent around in a circle, hoping thereby to transmit vertically, but not horizontally. Such an aerial amounts to two horizontal coils, the current in one flowing in the opposite direction to the current in the other. (See Fig. 18.)

An aerial of this type was wound on a cubical frame 16 feet along the edges and by turning the frame it proved possible to send a beam of signals along the ground in any direction. An aerial was wound on one of the hangars in such a way as to be directive upward. The two coils were rectangular, 40 ft. x 60 ft., and spaced about 12 feet apart. A current of 15 amperes was obtained at 1,450 meters. The circuit used is shown in Fig. 19. Two vertical fore and aft coils having five turns each were wound on the struts of the aeroplane. These coils had a horizontal dimension of four feet and a vertical dimension of 6 feet, 9 inches.

A flight was made using an SE-1405 amplifier during which signals were heard for two seconds at heights from 50 to 750 feet above the hangar. No greater heights were tried at this time.

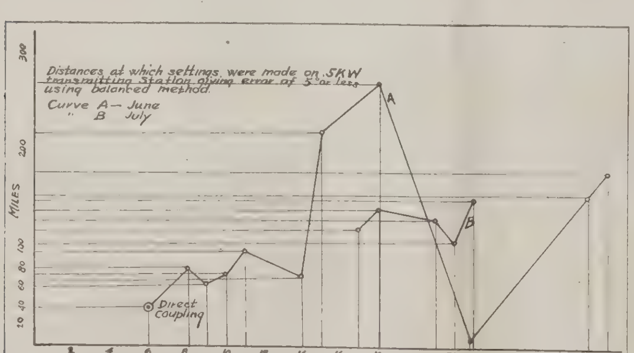


Fig. 20

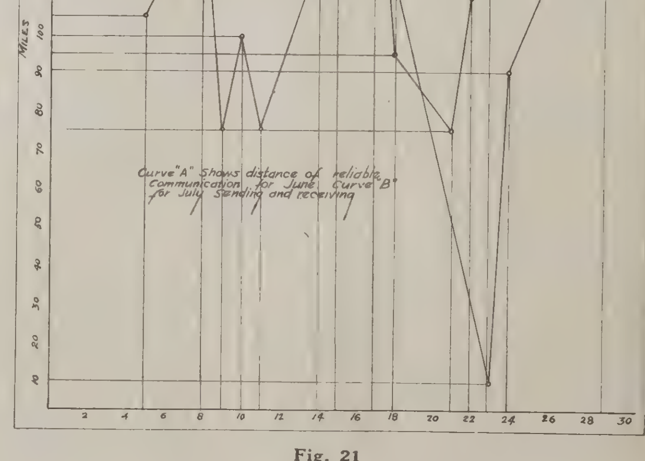


Fig. 21

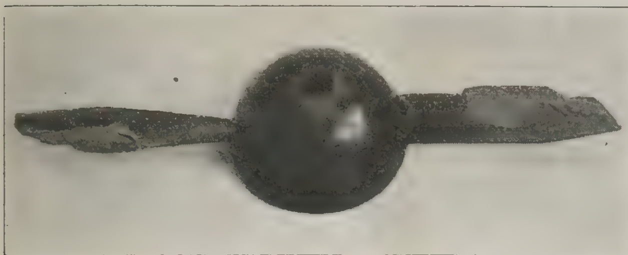


Fig. 23

At about this time it was found that the Western Electric interphone set which was used for communication between pilot and observer resulted in the decreasing of a signal of 5,000 audibility to one of 250 audibility. This interphone was therefore removed and another flight made. Signals were heard at a height of 2,700 feet when the engine was running. At a height of 1,300 feet signals were heard for a time of 15 seconds except that when the plane was immediately above the hangar no signal was audibile.

From theoretical considerations it appears that the field radiated from such an aerial should be nearly in the form of an inverted cone with a hollow center, that is, signals should be inaudible at points immediately over the center of the aerial but audible at quite a distance on either side. The shape of this field is shown in Fig. 20. A paper by G. Breit, giving the theory of this type of aerial, is in preparation as a Scientific Paper of the Bureau of Standards.

The successful tests obtained with the radio signals indicate that it is probably advisable to carry on further work along this line rather than to depend on induction signaling. This will have the advantage that no additional receiving apparatus will be required for use on the plane since the landing signals can be heard on the regular direction finding apparatus. A different spark or group frequency can be used in order that the pilot may distinguish between the landing and the direction finding signals.

Results could be obtained more rapidly by the use of balloons, thereby making it possible to make quantitative measurements of the received signal at various points above the landing field. In this way the whole field could be plotted out and constant measurements made of the signal intensity with various types of transmitting aerials.

It seems likely in view of the present experiments that by the use of higher power transmitting apparatus the radio signaling system described will prove very satisfactory. However, it is advisable to experiment with coils having various numbers of turns and with various spacings between the coils and enclosing larger and smaller areas. The current distribution in the transmitting aerial may also be very important.

One of the most serious difficulties in work of this sort has been due to interference from the aeroplane engines. By utilizing the present knowledge of methods for eliminating such intereference it seems likely that apparatus could now be developed for lighting a lamp or giving some other visual signal to the pilot as he approaches the landing field.

Photographs showing one of the planes in flight and a close-up view of the wing on which coils are wound, shown in Figs. 21 and 22.

V. Conclusions and Problems for Future Work

In view of the results of the experiments described above and of the distance over which it is known that aeroplane radio communication has been conducted, it is believed that the present development of aeroplane radio communication and radio direction finding is satisfactory for most practical work. It is highly important, however, that the precautions which have been found necessary in the installation of radio receiving and direction finding apparatus on aeroplanes be followed very exactly, for if any one of the requirements is not followed it may result in the entire failure of the apparatus to function satisfactorily. The necessary requirements which have been found are as follows:

(1) *Location of Apparatus.* The direction finder must be located in the fuselage of the machine and as far from the engines and the wires of the ignition system as possible. The amplifier must be located at least one or two feet from the nearest metallic object and the tubes of the amplifier must be enclosed to protect them from the vibration resulting from the noise of the engines or the rush of wind.

(2) *Ignition System.* The wires of the ignition system, including batteries and control switches, must be located as near the engines as possible and at a considerable distance from the direction finding antenna and the apparatus of the receiving set. In such a case the pilot would have to be provided with mechanical means for operating these switches.

(3) *Use of Compensating Coil.* If there are important reasons why the wires of the ignition system can not all be located near the engines, it is necessary to use a compensating coil. This coil must be adjusted by trial in such a way as to eliminate the emf induced in the receiving aerial at all positions of the latter.

(4) *Radio Apparatus.* It is necessary to use first-class apparatus throughout, being sure that it fulfills all radio requirements and also is rugged enough in its construction to withstand the severe vibration encountered in service on aeroplanes. It is advisable to require the apparatus to undergo severe preliminary tests if one expects to avoid interruptions to service during flight.

A number of problems may be mentioned among those on which investigation is most needed in order to continue the development of aeroplane radio communication. The satisfactory solution of these problems should result in:

(1) More reliable communication with a smaller number of failures during service.

(2) An increase in the distance covered by apparatus of a given power and sensitiveness.

(3) An increase in the simplicity of design of the apparatus and a resulting case of manipulation on the part of the operator.

(4) Direction finders should be developed for use on the

(5) Increased amount of traffic handled within a given time.

It is believed that the value of these results would be great enough to warrant the expenditure of a considerable amount of attention to the solution of these problems:

(1) Study and measure the direction and intensity of the field radiated from a transmitting station on land and from a transmitting station on an aeroplane. This would be of especial value in perfecting the landing signals and might also make it possible to develop a method for transmitting signals in a single desired direction. Work of this kind could conveniently be done with the use of a captive balloon.

(2) In some aeroplanes passengers are carried in an almost completely enclosed compartment. The greatly reduced noise from the motors under such conditions makes it seem likely that it would prove to be of great advantage to enclose as much of the radio compartment as possible with a layer of thick felt or other sound-resisting material. It might be advisable to even provide a cover for the compartment, though a substan-

(*Concluded on page* 163)

Fig. 22

FOREIGN TECHNICAL DIGEST

Airship Piloting

This paper by Major G. H. Scott, C.B.E., A.F.C., was read before the Royal Aeronautical Society, London. It is divided into four sections: (*a*) Aerostatics of Airships; (*b*) Aerodynamics of Airships (being necessary in order to understand the next two sections); (*c*) Weather with Regard to Airships; (*d*) Navigation.

Aerostatics—The lift of pure hydrogen is between 70 and 72 lbs. per 1,000 cu. ft., but in practice it is only possible to obtain hydrogen of 90 per cent purity, and consequently its lift is proportionately reduced. The density, and therefore the lift also, varies with pressure and temperature, the well-known laws of Boyle and Charles applying with sufficient accuracy for the estimation of this. Superheating, *i. e.*, the effect of the sun's rays in raising the temperature of the gas inside the envelope above that of the surrounding atmosphere also affects the lift, and must be compensated for.

Aerodynamics—The head resistance, which will vary with the size, *i. e.*, the capacity of the envelope and consequently the lift, affects the speed. This again, affects the machinery and fuel weight and with it the amount of the dynamic lift available for useful load. The relationship between these must be very carefully watched in the design of large ships of long range. The amount of water ballast necessary to counterbalance the loss of fuel weight and possible superheating of the gas, may nullify the advantage gained by the increase in size.

Weather—In general, a strong wind only acts over a small area, as the strength of a wind depends upon the comparative closeness of the isobars. Therefore a pilot should always turn broadside on to a strong wind and thus take the shortest path out of it. With accurate advance meteorological information upon the existence of air disturbances he should be able to steer a triangular instead of a straight course, and at least take partial advantage of a wind which is blowing. Westerly winds increase with height and easterly ones decrease, both tending to turn anti-clockwise. This fact is useful in setting a definite course to a certain point. The permanent trade winds can also be taken advantage of on certain routes. The possible temperatures due to the geographical situation of the route should also be estimated and their effect in superheating allowed for. Electric storms can usually be avoided, as they follow certain definite tracks at certain periods of the year and seldom travel out to sea. Clouds and fogs can be avoided by flying over or under them.

Navigation—The ordinary nautical methods apply, with certain limitations, dead reckoning, sun and star sights, and the use of the naval pattern sextant being generally preferred. Other methods more particularly applicable to aircraft are the use of the R.A.E. bubble sextant and directional wireless. (*The Aeronautical Journal*, Feb., 1921.)

A Dust Explosion and Its Prevention

The circumstances are described under which a fatal explosion of aluminum dust occurred in one of the finishing departments of a factory making aluminum utensils. The finish was obtained by polishing the utensils on lathes, the dust being collected in hoods feeding into a duct running under the bench and leading to an exhaust fan. This fan delivered the dust into a vertical pipe which had its discharge on the roof of the building. The explosion was due to a piece of No. 7 B. & S. gauge iron wire which had somehow got into the discharge pipe and had come into contact with the blades of the fan, thereby, no doubt, creating a spark which ignited the dust. The explosion was fatal to the operatives working near the blind end of the suction pipe. The new ventilating system devised to avoid a recurrence of the accident provides for induced ventilation. The hoods collecting the dust from each brush are led independently directly outside the building, and clean air under pressure is provided from a pressure fan through a duct again running under the bench, this air being blown into the exhaust ducts coming from the lathes in such a way as to induce the necessary depression in the hoods. The aluminum dust thus never comes into contact with any moving machinery, and the danger of an explosion is thereby reduced to a minimum. (*Chemical and Metallurgical Engineering*, Nov. 10, 1920.)

DH-14 Bomber

The de Havilland Aircraft Co. have recently been requested by the British Air Ministry to carry on with the construction of a number of the above machines, which were designed by Capt. G. de Havilland just prior to the armistice, but owing to the cessation of hostilities the construction was suspended.

Outwardly the DH-14 resembles in many ways the DH-9a, but constructionally there are many departures from the earlier designs.

It is a two-seater tractor biplane fitted with a 600-h.p. engine.

In the rear of the engine is a fireproof bulkhead. The oil tank is situated in front of this bulkhead below the engine, whereas the petrol tank is carried just in rear of the bulkhead. The gravity tank is in reality the upper portion of the main tank. Pressure is maintained by two independent windmill pumps situated on top of the fuselage below the center section.

The pilot is situated aft of the main planes, with the observer in a separate cockpit behind. For purposes of offense the DH-14 is fitted with internal bomb-racks for six 112-lb. bombs carried in two double and two single bomb-carriers, the former situated just in front of the pilot's cockpit between the front and rear legs of the under carriage, and the latter directly under the pilot's seat.

The defensive armaments consist of one stripped Vickers gun on the left of the pilot, and a Scarff ring on the observer's cockpit, for either single or double Lewis guns.

The fuselage is built up of four longerons, with the usual cross struts braced with streamline wires. Instead of the previous method of joining the front and rear portions of the fuselage with a splice, the longerons are made up of a series of short straight lengths with aluminum blocks inserted between each length. Four of these aluminum blocks, two on each longeron, occur at points where the undercarriage Vees are attached to the fuselage, the blocks forming bases for the various cross-members of the fuselage, the undercarriage and the wiring plates, the idea being that in the case of high speed, heavily loaded machines the landing stresses are absorbed by these blocks instead of crushing, and consequently weakening, the lower longeron.

The fuselage is fabric covered from the fireproof bulkhead aft, the sides being slightly bulged.

The tail plane is of normal D. H. design, with the exception that no upper bracing is fitted so as to give the back gunner an increased arc of fire.

A number of illustrations accompany this article, showing constructional details. (*The Aeroplane*, Feb. 9, 1921.)

Application of Photography in Hydrography

Attention is called to the importance of the paper submitted to the French Academy of Science by M. Volmat, in which he gives particulars of aerial photographic experiments carried out from a hydroplane, and emphasizes the importance of such a method in drawing up sea charts, so as to obtain quickly and exactly particulars relating to the lie of the coast, the conformity of shoals discovered at low water, etc.

In the tests carried out 17 m. below zero on the chart was the greatest depth at which the bottom could be clearly seen. Great depths produce a characteristic surface movement of the waves. From the impressions on a photographic plate of wave action it has been possible to discover a point of rock 8 m. below zero.

The photographs were taken vertically and generally at an altitude of 2,600 m. (*Ingegneria Italiana*, Nov. 4, 1920.)

"Elektron"

This alloy, which has been used in Germany for some years, contains magnesium to the extent of 90 per cent by weight. It has a fine silver-white color, takes a fine polish, and has a specific gravity varying between 1.74 and 1.83.

The cast metal has a tensile strength of 7.6 to 9 tons per square inch, with 5 to 6 per cent extension at rupture. Rolled or stamped, the tensile strength increases to 11.5-14 tons per square inch in the hard condition, and to about 10 tons when annealed. It can be melted in iron crucibles, ignition only taking place when the metal is heated about melting point, which varies between 630 and 650° C., or when it is in a finely divided state.

It possesses the advantages compared with aluminum of resisting alkalies, but is, on the other hand, easily attacked by acids, and to some extent by salts, as well as by sulphates and chlorides of heavy metals. Exposed to the atmosphere, it becomes covered with a thin layer of oxide, which protects against further attacks; the alloy is consequently more durable than iron. It is completely proof against petrol, acid-free oils and grease.

The metal can be stamped, rolled, drawn, etc., at a temperature of 400° C., and forged at temperatures between 220 and 250° C. When worked cold, it becomes brittle, but recovers ductility on being annealed. (*Verkstäderna*, Oct. 16, 1920.)

NAVAL and MILITARY AERONAUTICS

Report on Atlantic Fleet Naval Squadron

Secretary Denby authorizes the following:

The Navy Department has received a report from the Naval Air Station, Hampton Roads, telling of the safe arrival there on Wednesday of the Atlantic Fleet Air Boat Squadron and giving a summary of the record cruise just completed. Since last December the squadron, under command of Commander A. C. Read of Trans-Atlantic flight fame, has covered a total flying distance of about 10,000 miles without a serious mishap.

They left Hampton Roads for the Canal Zone by way of Guantanamo, on December 18, 1920, arriving at Guantanamo on January 13, 1921. On the 15th, the Squadron was at Kingston, Jamaica, and left for old Providence Island on the 17th, and from there for Colon on the 19th, arriving at Colon on the same day. The distance from Guantanamo to Colon is 815 miles, and was made in the flying time of 11 hours and 5 minutes.

After joining the Pacific Fleet Air Forces in manoeuvers south of the Canal Zone, the Squadron left Colon for the North on February 19th, by way of Great Corn Island, Belize, Isle of Pines, to Guantanamo, arriving at Guantanamo on March 2nd, covering the 1951 miles in 35 hours and 35 minutes.

On April 6th, after Fleet manoeuvers off Guantanamo, the Air Boats left for the North by way of Isle of Pines, Miami, Charleston, and Morehead City. The Squadron was manned by practically the same crew which operated the Air Squadron during the winter of 1919 in the Caribbean Sea, and their intimate knowledge of motors and seaplanes enabled Commander Read to carry out his schedule without delay, and, when crossing the Caribbean, to take the air for a long flight during a storm in which the tender, *Sandpiper,* was unable to go to sea.

Radio apparatus and compass equipment was tested out during this long voyage and the most gratifying results were obtained in keeping formation and navigating even when visibility was limited by fog and rain.

Army Fliers Defeat Navy Pigeons in Race

San Francisco—Major H. H. Arnold, air service officer of the United States Ninth Army Corps area, and Governor Ben W. Olcott, of Oregon, landed here late April 11th on their aeroplane flight from Portland, Ore., in a race against six navy carrier pigeons.

Their actual flying time was five hours and thirty-three minutes. The distance is 722 miles, and the time is said to be a record.

The pigeons, released ten minutes before Major Arnold took off from Portland, did not land until the next day.

Army Planes Have Begun Survey of Olympic Peninsula

According to reports from the Commanding Officer at Mather Field, Sacramento, California, and to special press dispatches from Hoquiam, Washington, two army aeroplanes, one piloted by Captain Lowell H. Smith with District Forester Cecil, of Portland, Ore., as passenger, and the other piloted by Lieut. Emil C. Kiel and carrying an observer, made a preliminary flight on the 28th of March over the storm-damaged area on the west side of the Olympic Peninsula.

The two planes left Camp Lewis just before noon, crossed to Shelton and thence over the southern edge of the Olympic mountains to the vicinity of Lake Quinault, crossing the Queets River near the mouth of the Clearwater, thence north along the coast to the Hoh.

From the Hoh valley the planes turned inland to the Forks Prairie flying low there to observe the possibilities of landing. From Forks they circled over the Ozette Lake district and returned south along the western edge of the mountains to Lake Quinault, and thence back to Camp Lewis. The flight was made in 2 hours and 50 minutes.

The extent of the damage done by the storm could be observed clearly. The fliers reported timber down only in patches, except in the Clearwater valley and the Hoh district, with the greatest loss in the Hoh and Bocachiel areas.

Plague Stops Virgin Island Flight

Washington.—The two aeroplanes piloted by marines which left here for a flight to the Virgin Islands last week are returning without having reached their objective, it was announced at the Navy Department. The planes turned back at San Domingo City, it was said, because of a bubonic plague epidemic at San Juan, Porto Rico, the next and last stop scheduled before the Virgin Islands.

The planes returned to Port au Prince, from where they are scheduled to fly to Guantanamo. They will retract the route taken on their outbound flight on their return here.

The object of the flight was to map out an air route to the Virgin Islands and demonstrate the feasibility of land-type planes making a long cruise over both land and water.

Congressional Committee Inspect Canal Defenses

The Director of Naval Aviation has received a report from the Commandant of the U. S. Naval Air Station, Canal Zone, covering the vist to the station on March 23rd of the Congressional party which recently inspected the Panama Canal and its defenses. Several of the party were taken up for short flights in Naval aircraft and a number of flight demonstrations were given.

On March 25th Congressman Frederick C. Hicks, member of the House Naval Affairs Committee, made an official inspection flight in a seaplane of the Canal, including all fortifications, harbors, docks, inlets and locks and the coast line for a distance of thirty miles in both directions on either end of the Canal. The planes remained in flight for a period of over three hours. During this time both the Atlantic and Pacific near approaches to the Canal were covered, including the islands on the Pacific side, particularly Toboga, and the Atlantic islands around Manzanillo Point and elsewhere adjacent to the gulf entrance of the Canal.

Various tests were carried out during the flight; radio messages were sent and received. A message was sent to the Commandant of the 15th Naval District by Mr. Hicks in the bow of his F-5-L to personally test radio communication from aircraft to shore. A message of 14 words was sent and an answer of 16 words received by him in eight minutes. In all a total of 14 passengers was sent and received, including signals exchanged between planes and Colon and Balboa. Orders were delivered by radio for subchasers and Eagle boats to leave their stations and take certain positions, given by radio, while the seaplanes were flying over the Canal, and as a result a general perspective of the operations at Coco Solo was received in one flight.

The smartness of the Coco Solo station and the spirit of the personnel were very favorably commented on, the report states.

Aerial Carnival at Mitchel Field

Five aviators will attempt to jump from an aeroplane at the same time in a parachute exhibition on May 1st next as a feature event of the aerial carnival that is to be held at Mitchel Field, Mineola, L. I., by the aviation officers of the field.

Changes of Station of Army Officers for Week Ending April 5

March 30, 1921.—First Lieutenant Edward M. Morris, ordered from March Field, Riverside, Claifornia, to Langley Field, Hampton, Virginia, for the course of instruction at Photographic School.

March 31, 1921.—Orders previously issued directing First Lieutenant George W. Pardy to proceed from Mather Field, Sacramento, California, to Manila, on the May transport, amended to direct him to proceed on the transport sailing July 5, 1921.

April 1, 1921.—Following Cavalry officers detailed to Air Service and ordered to return to the United States from the Philippine Islands and report at Carlstrom Field, Arcadia, Florida, for pilot training not later than July 28, 1921:

Captain Robert C. Candee,
First Lieutenant Richard H. Ballard.

April 2, 1921.—First Lieutenant Ernest L. Hurst ordered from Brooks Field, San Antonio, Texas, to the San Antonio Air Intermediate Depot, Kelly Field, San Antonio, Texas, for duty.

April 2, 1921.—Captain Ralph A. Gibson ordered from Army Balloon School, Fort Omaha, Nebraska, to Fairfield, Air Intermediate Depot, Fairfield, Ohio, for duty.

April 4, 1921.—First Lieutenant Ned Schramm ordered from March Field, Riverside, California, to Mather Field, Sacramento, California, for duty.

Navy Flyers Cover 10,000 Miles Without Serious Mishap

Washington.—The Atlantic Fleet Air Squadron that returned to Hampton Roads last week after a cruise through the tropics, covered a total flying distance of 10,000 miles without serious mishap, Secretary of the Navy Denby announced April 17th. Commander Read, who commanded one of the N-C craft in their transatlantic flight, headed the squadron.

FOREIGN NEWS

Prague to Hold Second Aero Show

Encouraged by last year's success, Czecho-Slovakia is organizing its second Aero Exhibition at Prague from September 25th to October 2nd.

Ecuador-Colombia Air-Mail

An "air-mail" has been carried from Carchi in Ecuador to Pasto in Colombia by Signor Guicciardi, an Italian pilot, this being the first mail by plane between the two republics.

Aviation in Siam

The interest taken by Siam in aeronautics and railways is remarkable and highly creditable to her Government, our Indian correspondent states. Under French instruction she now has a larger number of the newest machines, competent pilots and better aerodromes than any other Asiatic power.

Austrian Civil Aviation

Austrian papers declare that the continuous endeavors of leading circles, as, for instance, the Vienna City Council, the Austrian Air Ministry, and the Austrian Aviation Clubs, to include Austrian aeronautics in international air traffic have been accompanied by a modicum of success that must be described as satisfactory to the appellants.

The Entent has decided to exempt from destruction a certain number of hangars and plants needed for their up-keep, and has notified as such two single and one double hangar on the Vienna-Aspern flying ground, a depot for material, a garage, two workshops, and several offices for management and customs officials; at Graz, two hangars and repair-shops, in Klagenfurt one hangar, etc., and at Innsbruck two hangars for the establishment of an aviation station there.

The President of Uruguay Flies

President Brum, of Uruguay, decided to take a view of his capital from an aeroplane. It is understood that he invited Mr. Wilmot to take his Bristol to Montevideo, which he did, carrying as passengers two Englishmen. Afterwards, His Excellency honored the pilot by becoming his passenger for a flight lasting over an hour, during which they passed over most of the suburbs and outlying villages near the capital. They were accompanied by General Buguet, Minister of War.

The President expressed himself as greatly pleased with his experience. Mr. Wilmot, who is very popular in Montevideo, has been asked to prolong his visit.

Baden Airship Shed to be Destroyed

The Inter-Allied Aeronautical Control Commission has sent a note to the Baden-Baden Town Council demanding that the airship hangar at Baden-Oos be pulled down at once. The town bought the huge hangar some years ago from the original proprietors, the Delag Company, for 80,000 marks, and it was from here that the "Victoria Luise" started on her beautiful circular tours through the Black Forest, Vosges and Odenwald.

The Badenian Air Company, which intends to ply from Frankfort to Lorrach and later on to Munich, is in a state of great anxiety, as this order will annul all its plans, the Baden-Oos station playing a prominent part in the enterprise.

The Bavarian Air Lloyd Reopens

The Bavarian Air Lloyd, whose complete stock of passenger machines was demolished under the Versailles provisos, recommences regular aerial service from Munich to Lake Constance in the course of March. The Swiss Ad Astra Aero Company connects traffic with Zurich.

The Aero Club of Alsace-Lorraine

The Aero Club of Alsace-Lorraine has been founded at Strasburg under Millerand's patronage, with Marshal Foch and Generals Hirschauer and Castelnau, who are of Alsatian descent, as honorary members.

The Argentine Aviation Co.

The Argentine Aviation Co. is a small private partnership between M. J. Guichard, late of the French Flying Corps and a son of a well-known family of French planters in the Argentine, and Prince Murat, who will be remembered by some as the original French liaison officer to the first R. F. C., H. Q.

They have five Spad side-by-side two-seater biplanes (80-h.p. Le Rhône) in the country, and in addition have three Spads, four Henry Potez Type VIII side-by-side two-seater biplanes (45-h.p. Potez air-cooled engines) and one Besson dual-control flying-boat on the way out. Furthermore, they have options at very advantageous prices on a large quantity of French Disposal Board material, including 45 80-h.p. Le Rhône engines.

New Flying School at Sao Paulo

It is reported that a civilian flying school has been opened at Sao Paulo by three Italian ex-army pilots, Signores J. and H. Robba and D. Bertone.

Three S.A.M.L. biplanes with 110-h.p. Le Rhône engines are in use, and four further Italian machines, together with three "Aviatiks," are expected. It is stated that the school has been besieged by would-be pupils.

Lloyd's Aviation Record

Apart from the register of machines recently issued by the Air Ministry, Lloyd's have compiled a most comprehensive record of all aircraft licensed for commercial purposes. The particulars are obtained from the Air Ministry and from the owners, and every care is taken to keep the register up to date. The following details are given of all machines licensed: Owner, address, etc.; maker's number and identification mark; country of origin; type; date when completed; passenger accommodation; date first flown; endurance with full load; weight per sq. ft. fully loaded; weight of cargo, including passengers; total weight fully loaded; minimum landing speed fully loaded; description and number of certificates; dates of issue, expiry and renewal of airworthiness certificate; engines; maker; engine cylinders, b.h.p., cooling, ignition and gearing; type of tanks; nature of service since built; source of information and date; any deviation from standard type; construction; accidents.

The pilot's register has been built up in a similar way and gives name, address, etc.; age; date of birth; nationality; description and dates of certificates and licenses; types licensed to fly; general experience and hours flown per type; source of information; accidents; date of last medical examination; date of last flight and type of aircraft.

Dutch Government Order for Seaplanes

The Dutch Navy has given the "Van Berkels Patent" firm of Rotterdam an order for the construction of two-seater seaplanes for service in the Dutch Colonies. These machines are two-float monoplanes with thick wings which are attached to the floats by means of struts; the fuselage is placed high up and the machine fitted with a Rolls-Royce Eagle VIII engine. The floats, which have several steps, are of duralumin, as plywood floats deteriorate in the tropics.

Commercial Aviation Grants

Hungary has adopted public service for its air traffic, as aviation has there been assigned to the Trade Office. This step of converting the former military air service into a civil office is one the authorities were prevented from following in Germany owing to the peace terms. Czecho-Slovakia has chosen the form of a private monopoly, which has been granted to the "Air Traffic Co., Ltd.," of that country. Denmark gives concessions to the air transport firms as a cheap reward in return for their pioneer work. It is understood that a local company, financed by German money (the Lloyd Air Service combine), has so far been prevented from obtaining this privilege. Uncontrolled aviation has so far been adhered to by America. France and Germany have both adopted subsidies, the latter country in form of a grant of 10 and 15 marks respectively for single and twin-engined aeroplanes per flight kilometre.

The Nobile Parachute

On Saturday, March 12, some interesting experiments were made near Rome with a new type of parachute designed by Ing. Nobile, of the Italian Department of Aeronautical Construction. This parachute is intended to carry the whole weight of car and crew. At a height of about 300 metres, Ing. Zesi, who was in the balloon, detached the car and it came slowly to the ground, thanks to Nobile's parachute, which worked perfectly. This experiment is the first of its kind, and it roused the enthusiasm of all present, amongst whom were the various foreign Air Attachés and the American and Spanish Aeronautical Missions. The only absentee was a British representative.

A Fish Patrol

The Avro machines imported into Iceland last year have done excellent work, particularly in the discovery of shoals of fish. The aerial fleet employed for this purpose is being enlarged by the addition of several new Curtiss biplanes.

Italian Aviation at the Cross-roads

Tired of being befooled by Commissions, Committees, Directorates and Ministries, practical men are slowly and surely rising up in their rage against the unnecessary red-tape binding, or, rather, winding-sheets in which civil aviation was wrapped by the politicians at its weak birth.

So Ernest Breda is seen boldly plumping for transport by the only open road, and engaging his big works and means in the building of new or transforming of already well-known weight-carrying aircraft.

At Turin Lepore is fetching and carrying by the airway, and Rome and Naples are full of activity.

With the hoped-for and almost certain advent of Colonel Moize to the helm of civil aviation, and the helicopters of the pure-blooded Italian Marchese Pescara and of Ing. Somabrico—a local experimenter whose machine fitted with an I.F. engine has given encouraging results—things look most hopeful in Italy.

As the rules for the Schneider Cup have been made so much easier it is hoped that foreign competitors will turn up on July 31st at Venice.

Parachutes for Stunting

The Office Aerien Federal, in making special regulations with regard to stunting in Switzerland, specifies that pilots and passengers so indulging must carry parachutes of a type officially recognized by the Office.

As the result of tests, the "Heinecke" parachute, manufactured by Schroeder and Co., of Berlin, has been officially recognized as being suitable for use in Switzerland.

The Office Aerien is ready to examine and test other types, for which their recognition is required.

A 1921 Paris Aero Salon

It has now been decided by the Executive Committee of the "Chambre Syndicale des Industries Aeronautiques" to hold an International Aero Show at the Paris Grand Palais next November.

F. A. I. Enlarges Its Membership

The Aero Clubs of Chili and China have been admitted temporarily to the F. A. I.

France to Honor Air Travelers

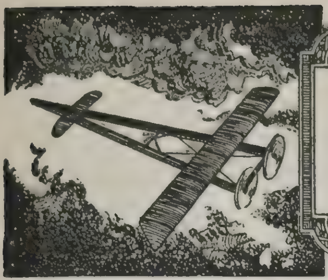
From Paris it is reported that the French Aero Club has decided to award annually a special medal to a certain number of air travelers having the greatest air mileage to their credit. Professional aviators will be excluded. It is hoped that this award will help to encourage travel by air.

A New Morane-Saulnier Monoplane

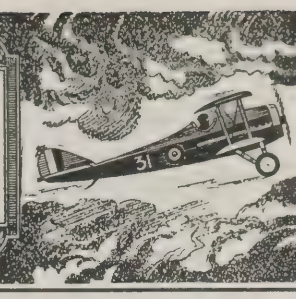
We learn that M. Saulnier has just completed the designs for a large cantilever monoplane which is to have seating accommodation for 16 passengers, and will be driven by three Lorraine-Dietrich engines, of which two will be placed in the leading edge of the wings, the third in the nose of the *fuselage*. The monoplane wing will have a span of 88 ft. 6 in. and the wing area will be 1,250 sq. ft. The weight empty has been estimated at 4,300 kilograms (9,450 lbs.) and the weight "all on" at 7,000 kilos. (15,400 lbs.). It is estimated that the machine will take off with two engines only, and fly at 1,500 ft. on one engine.

Tablets in Paris Mark Aerial Raids

On the wall of the Credit Lyonnais Bank, Rue de Choiseul, a tablet has been placed bearing the inscription, "Aeroplane Bomb. Jan. 30, 1918." The Ministry of War has had tablets placed on the walls of the houses near which the first and last bombs of the war fell in Paris, and it seems to be the general custom for private individuals to mark with some simple inscription the various points of the capital where damage was done by German bombs or shells.



ELEMENTARY AERONAUTICS and MODEL NOTES



CLUBS

PACIFIC MODEL AERO CLUB 240 11th Avenue, San Francisco, Cal. Portland Chapter: c/o J. Clark, Hotel Nortonia, Portland, Ore.	NEBRASKA MODEL AERO CLUB Lincoln, Nebraska	MODEL AERO CLUB OF OXFORD Oxford, Pa.
INDIANA UNIV. AERO SCIENCE CLUB Bloomington, Indiana	BUFFALO AERO SCIENCE CLUB c/o C. Weyand, 48 Dodge St., Buffalo, N. Y.	CAPITOL MODEL AERO CLUB 1726 M St., N. W., Washington, D. C.
BROADWAY MODEL AERO CLUB 931 North Broadway, Baltimore, Md.	ILLINOIS MODEL AERO CLUB Room 130, Auditorium Hotel, Chicago, Ill.	AERO SCIENCE CLUB OF AMERICA Beach Bldg., E. 23rd St., New York City
PASADENA ELEM. AERONAUTICS CLUB Pasadena High School, Pasadena, Cal.	SCOUT MODEL AERO CLUB 304 Chamber of Commerce Bldg., Indianapolis, Indiana	AERO CLUB OF LANE TECH. H. S. Sedgwick & Division Sts., Chicago, Ill.
	MILWAUKEE MODEL AERO CLUB 455 Murray Ave., Milwaukee, Wis.	LITTLE ROCK MODEL AERO CLUB 1813 W. 7th St., Little Rock, Ark.

Scale Models Built by Aerial Age Readers

An excellent example of the good results obtained by following scale model plans published on the "Elementary Aeronautics" page, is the S. E. 5 model, built by Bruce A. Mapes, of Brooklyn, N. Y. This model, as the photograph shows, bears a striking resemblance to the real full-sized aeroplane.

Some departures in construction have been made from the published description, as Mr. Mapes desired more of an exhibition model than called for in the specifications.

Wings were built up with 1/8" square spars with 3/32" reed for leading and trailing edges. Ribs were made of balsa wood. Such features as the balsa wood dummy engine and imitation exhaust pipes add to the appearance. The special S. E. 5 tail skid has been reproduced in principle and acts just as in the real machine. The landing gear is provided with streamline members and rubber shock absorber. The propeller, which is 9½" long, clears the ground by ¾" when the model is horizontal. The propeller shape of the full-sized S. E. 5 has also been copied. The wings are made detachable. The entire machine is finished with two coats of shellac after doping, and the result is a shiny finish.

Thirty-five feet of 1/8" flat rubber has been found to fly the model very well. The weight of the model complete is nine ounces. Although the weight is quite light for a model of this type, the weight would have been even less if such display details as the control stick and movable surfaces, had not been desired.

Photographs of other interesting models built by Mr. Mapes appeared in the January 17, 1920, issue of AERIAL AGE.

Notes of the Pacific Model Aero Club

Recent advices from Mr. R. C. Hansen, secretary of the Pacific Model Aero Club of San Francisco, Cal., contain reports of the club's activity. The following members have been elected to office: President, Hulbert A. Burgess; vice-president, Preston Hopkins; secretary, R. D. Hansen.

Mr. Burgess recently made a visit to the club's Portland Chapter, receiving favorable reports of progress from the president and secretary, Messrs. J. Clark and A. Roenicke. It is Mr. Burgess' aim to organize a Pacific Coast Model Aero Club's Co-operation League which he hopes to have in full swing this summer; in this respect he intends to make a trip to the southern part of the State, taking with him a number of models as an example of the club's work along those lines.

A drive for new members is now open for young men under sixteen who are invited to apply for membership. Attention is called to the addresses of the Pacific Model Aero Club and its Portland Chapter which have just been added to the list of Model Clubs at the heading of the "Elementary Aeronautics" page. These clubs have often been confused with the Pacific Northwest Model Club of Seattle, Washington, but there has been no connection between them. Mr. Burgess, who was formerly a "Northwest" member, received information from Mr. Robert LaTour, president of that club, that the Seattle organization is no longer engaged in model activities.

Early Model Aeroplanes

An interesting rubber-driven model aeroplane was produced as early as 1871 by M. A. Penaud. The model was propelled by a single screw actuated by twisted rubber in a manner very similar to that employed by modern model builders. The center of gravity of the model was well forward, tending to set the machine in a nose dive, but this maneuver was prevented by a quick-acting elevator inclined to counter-act that tendency. The principle of control by elevator movement was expounded in 1811 by Sir George Cayley. The Penaud model flew a distance of 131 feet in 11 seconds.

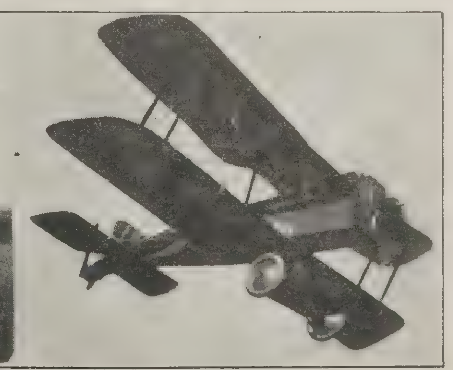
Human flight was shown to be practicable by the twin-tractor monoplane model built in 1879 by M. Victor Tatin. The propellers were driven by a compressed air engine. The entire plane weighed slightly less than 4 pounds and had a wing area of nearly 1,300 square inches. The compressed air was contained in the body, which consisted of a thin steel tube three feet long by four inches in diameter and weighing 1½ pounds. It was capable of withstanding a pressure of twenty atmospheres. The model was flown whilst tethered to a stake at the center of a board-walk 46 feet in diameter. It quickly acquired a speed of 18 miles an hour, rose in the air and flew a distance of 50 feet.

Careful measurements revealed the fact that the model carried at the rate of 110 pounds per "tow-line" horsepower when flying at an incidence of 8 to 10 degrees. As Mr. Tatin was unable to bear the expense of building a full sized aeroplane to prove his theories, he left it to later experiments.

Twelve years after Tatin's experiment, a similar compressed air monoplane was built by L. Hargrave, of Australia. This model had a single propeller, but had no wheels for launching from the ground. The wing area was 20 square feet and the weight 3 pounds. The rate of flight was 128 feet in 8 seconds. Weight was carried at the rate of 90 pounds per horsepower.

Two years later he developed a small steam engine weighing 10.7 pounds per horsepower and capable of driving the model about two miles.

A 24-inch Flying Scale Model of the S. E. 5 aeroplane, built by B. A. Mapes from Aerial Age plans published December 6, 1920



To the Birdman

"Thou scorner of the ground!"
So said a poet of a bird
That skimmed the blue along,
Up, up, up, beyond all sight,
And left him but a song.

Thou scorner of the ground!
I say of you, my birdman bold,
Whom fear cannot ensnare,—
Just as a bird, you fearless fly,
So cool, so debonair.

Columbus, like you, sail
Uncharted seas of wind and storm,
"Sail on and on," you cry,
"To worlds of usefulness and gain
Dominion of the sky."

Like he of Lion-Heart,
You dare the perils of the great unknown;
On cunning wings, man-made,—
Armored in your faith, you go
To win the brave crusade.

In the History Class

Teacher:—What do you know about the statue "The Dying Gaul"?

Student:—It's all Greek to me.

Teacher:—Correct.

J. H. M.

First Sentry:—Did you ever known that whiskey shortens a man's life?

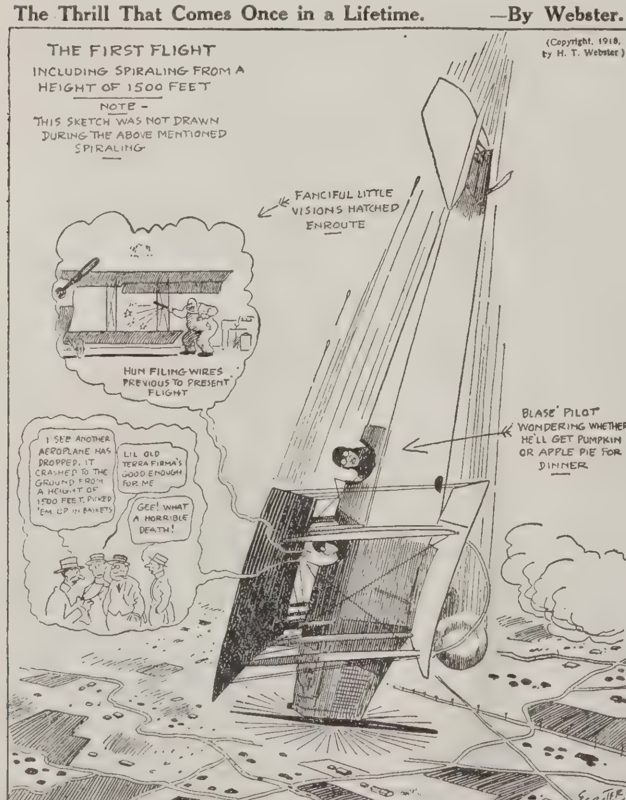
Second Sentry:—Yes, but he sees about twice as much in the same length of time.

J. H. M.

Small Town Stuff

Clipping from paper of very small, mountain town on the Tennessee-Georgia border: "Prof. —— arrived this morning

The Thrill That Comes Once in a Lifetime. —By Webster.



in biplane. Slight accident in landing. People in from miles around to see it. They came over the mountains at 5,000 feet."

It happened at the same place. The field was about the size of a tennis court, and we broke our undercarriage. However, we made another one and put it on the machine and started the engine. Just as the engine started I heard a voice back in the crowd say: "By gosh, I knowed it woulden't fly, its wings ain't a flappin'."

While makeing the repairs we meat an old mine foreman who drank nothing but "Fresh mountain dew." So before we even started the engine old John managed to climb into the front seat and wouldn't get out until he had a "ride in the air." The field was hardley large enuf for one person to take off much less two. But John would not get out, so I told Sib. to hold one wing and Roy to hold the other one to prevent me from going in the creek which surrounded the field. John had his head down in the cockpit at the time and we taxied down the field real fast and stopt and asked him how he liked the ride. He climbed out and said that he liked the ride but he couldn't see the ground while we were up.

We had pulled out of an unusually hard "dog fight." My machine was quite full of bullet holes and I was wondering what the little Scotchman's machine was like. In an ordinary fight he always came home full of holes. So I wondered about this one. I landed first and looked my machine over and, as I expected, it was full of holes. About this time Scotty taxied in, shut off and climbed out. He was so small that he could not see over the top of the fuselage, and very seldom talked to any one. First he looked at the left wing, then walked around to the nose, then on to the right wing, which to me looked like a sieve, but he did not say anything until he had seen the right side of the fuselage, which was also full of bullet holes. Then, just as solemn as an owl, he looked at me and then back at the machine and said, "Well, Gen. Sherman was right," and walked away. *Speed.*

The Silent Night

In the hush of the silent night,
When mortals and earth are all asleep,
Into the heavens' soundless deep,
Where the owl and the bat weird company keep,
The heavens are mine for flight.

The sky is black with care—
Black care and blacker despair and woe—
And the sough of the wind, as up I go,
Throbs by my wings with ominous flow,
To the dead, black darkness there.

Dark stillness all profound,
Stilling and chilling the mind and heart,
Gray curtains of smoky black that dart
Fears that would tear my soul apart—
Fears, without sight or sound!

Valleys of death are there,
And my plane tears into their fearsome deep;
Death and despair foul company keep—
Struggle for mastery in that black deep—
And the power of darkness is there.

Shades of the earth are they,
Fickle, unreal and false as hell,
Spawned by the shades of earth, that knell
The lost desires. But, grim and well,
My plane struggles through to the day.

HAROLD A. DANNE, in the *N. Y. Times.*

The Sweet Thing: I'm shocked at the way father treated you. I've always worshipped father, but now—boo-hoow—it seems—sniff—that my idol has feet of clay.

The Damaged Suitor (dynamically agitated): Aw, rats! Clay? Yuh mean concrete!—*The Searchlight.*

Reveille

"There was a sound of revelry by night—" began the elocutionist.

"Where d'ya get that stuff?" interrupted a hard-boiled auditor with a service button. "Any simp knows revelry sounds in the morning, not at night."—*American Legion Weekly.*

(*Continued from page* 157)

tial protection, along the sides and bottom, against the noise from the exhaust pipes would undoubtedly be a great improvement.

A complete cover for the compartment would be highly valuable as a protection against rain and would enable the operator to maintain communication under weather conditions which will make the apparatus entirely useless under the present arrangement. Protection against storms is one feature which is required by the unique conditions of operation of the Air Mail Service. Here the flights must be made under all kinds of circumstances, for nothing must interfere with the transmission of the mails.

(3) Study the distortion of the waves raised by the aeroplane direction finding apparatus. The waves are probably slightly distorted by the presence of the metal guy wires, the motors and other metallic parts of the ship. A determination should be made of the metal and magnitude of this distortion and methods developed either to eliminate it entirely or provide suitable calibration of the direction finder by preliminary observations on the ground.

(4) Direction finders should be developed for use on the ground in receiving signals form aeroplanes. It is at present questionable whether the direction indicated by direction finders now in use is reliable in the case of signals from planes which are considerable above the line of the horizon.

(5) A study should be made of the best location of radio beacon stations which may be established throughout the country and serve as transmitters of signals to any type of receiving station requiring the service. Signals could be sent on a certain time and wave length schedule and would be useful to postal aeroplanes, commercial aeroplanes, ships and other stations. The chief problems to be decided in this connection are the distance which should be allowed between adjacent stations in the network and the wave length on which these stations should operate.

(6) A low power radio telephone transmitting set should be developed which can be used for giving the pilot information when preparing to land when the visibiltiy about the field is low. When approaching the field under these conditions the pilot may call for information on the ceiling and must be told if local conditions are favorable or directed to a place where a safe landing can be made. A pilot who is overshooting the field can rfequently be seen from the ground and directed to alter his course so as to bring him over the field.

(7) Transmitting and receiving apparatus should be so combined as to provide two-way ordinary communication as is now the practice on land telephone lines. This would be of especial importance in radio telephony and would avoid the wasting of time and the frequent failure to conduct satisfactory conversation by the necessity of switching over from the transmitting to the receiving set.

(8) Radio telephone sets should be further developed so that the modulation obtained is the maximum and also to provide secrecy, or at least a greater freedom from interference by the wide frequencies which are existent with the present radio telephone sets.

(9) Measurements should be made of the constants of antennas which can be conveniently installed on the several types of aeroplanes in order that transmitting and receiving sets may be designed with full knowledge of the constants of the antenna circuits which will be used with them.

(10) More attention should be given to the details of the mechanical design of both transmitting and receiving apparatus. The weather and other conditions under which the Mail Service operates are extremely severe and it is of the utmost importance that careful attention be given to the design of apparatus to withstand these conditions if frequent failures are to be avoided.

(11) Work should be done on the design of a special antenna for use in transmitting radio signals from aeroplanes. Such an atenna should be rigid in construction, should have a large capacity and should be an efficient radiator.

(12) Circuits should be devised for linking the radio transmitting and receiving apparatus on the ground with the existing lines for wireless telephony.

(13) For some purposes it would be desirable to perfect means for the radio control of aeroplanes at a distance so that the aeroplane would be turned in any direction by means of a specified signal transmitted from a station on the ground.

705
A

AERIAL AGE WEEKLY

L. 13, No. 8 | MAY 2, 1921 | 10 CENTS A COPY

Photo by Fairchild Aerial Camera Corp.

Airscape of the Grand Central Zone, New York City. In the circle is the Foster Building, the home of Aerial Age Weekly

American Aviation Policy

ISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIII NEW YORK, MAY 2, 1921 NO. 8

American Aviation Policy

PRESIDENT HARDING has submitted to Congress, with his approval, a report of the National Advisory Committee for Aeronautics, in which are recommended a naval air service, an army air service, and a bureau of aeronautics in the Department of Commerce to regulate air navigation and to encourage civil and commercial aviation. The President agrees with the army and navy officers who controlled the subcommittee making the report that a single air department for military, Government and commercial purposes should not be created. On April 11 Chairman Kahn of the Military Affairs Committee introduced in the House of Representatives a bill providing for a single Bureau of Air "to make more effectual provision for the aerial defense of the United States and to provide for the concentration of national air strength." On the same day he introduced a bill "to regulate air navigation." The issue, then, of a single air department is before Congress.

In the report whose recommendations President Harding approves it is declared that "aviation is inseparable from the national defense," and that "it is of vital importance in time of peace to make the greatest possible progress in the science itself." And thereupon the committee proposes something that will impede "the greatest possible progress" in aviation; that is to say, it recommends a distribution of authority, initiative and responsibility among at least three agencies—the army, the navy and the Department of Commerce. "Neither the army nor the navy, nor both combined," says Brig. Gen. William Mitchell of the Army Air Service in his book, "Our Air Force, the Keystone of National Defense," "can be expected to develop, organize and perfect a flying corps and its employment to the greatest possible limit of which that weapon (the aeroplane) is capable." In his recent message to Congress President Harding said that "the civil development of aeronautics" must be encouraged to relieve the Government "largely of the expense of development and of maintenance of an industry now almost entirely borne by the Government through appropriations for the military, naval and postal air services." The President might have added, what is of the first importance, that if progress in aeronautical invention is to be promoted, the Government must have the co-operation and aid of the civilian or independent manufacturers. The prospect must be opened to them of selling their machines to companies engaged in freight and passenger traffic as well as to the Government for the army, the navy, and the Post Office and other departments.

How can the Government encourage the civilian manufacturers aside from giving them contracts? By developing air routes and building aerodromes in all parts of the country, for use by commercial aviators as well as by the army, the navy and the post office. The committee headed by General C. T. Menoher and Admiral D. W. Taylor recognizes the necessity of this in its report when it recommends that the Army Air Service take up the work, with as much co-operation as it can get from other Government agencies and from the States and municipalities. Indeed, the report to which President Harding gives his endorsement outlines a scheme of such magnitude that to submit it to several bodies for execution would be to court failure and to waste money. Concentration, and not distribution, is the key to success. Chairman Kahn's bills may need amendment, perhaps redrafting, but they point in the right direction. A nation that takes the lead in commercial aviation should have the best aerial offense and defense. (*Editorial in New York Times.*)

New Fight Looms Over Air Policy

THE fight for an independent air service, waged for the past two years, has broken out afresh and with increased vigor since submittal of the report of the National Advisory Committee for Aeronautics on a Federal air programme. In the controversy fanned by the report innuendoes are made that a report of a minority of the committee was withheld and President Harding deprived of part of the information he asked for.

All three civilian members of the National Advisory Committee, it is stated, signed the minority report. They are F. H. Russell, Glenn L. Martin and Sidney Waldon. Major W. G. Kilner is also stated to have signed the minority report.

This quartet in its minority report urged the President to direct the National Advisory Committee to consider and report on whether it is better to divide aeronautics among four departments, as is recommended in the majority report, or to establish a Department of the Air, a Unified Air Service or an Independent Air Force. They asked Dr. Charles D. Walcott, Chairman of the National Advisory Committee, to incorporate this suggestion with the majority report.

This was not done, and its omission is the ground for the charge that the President has been favored with only one side of the question. The majority report favors an Army Air Service, a Naval Air Service and an Air Mail Service conducted separately and independently as now, and a Bureau of Aeronautics in the Department of Commerce for regulation of air navigation. The National Advisory Committee on Aeronautics should be continued, the committee suggests, for scientific research in an advisory capacity for co-ordinating all Federal aeronautical activities.

While the four constituting the minority of the committee are advocates of an independent air service, in which all air activities shall centre, Dr. Walcott says they signed the majority report. Mr. Waldon says that the minority report, after omission from the account of the committee's findings delivered to the President, was sent to Mr. Harding. The showdown of strength between the advocates of the different policies will come in Congress, to which the majority report has been transmitted by the White House.

The News of the Week

Secretary of the Navy Launches Commercial Flying Boat

The first of a series of Naval Aircraft converted into flying boats for commercial aviation was launched by the Secretary of Navy Denby. In the launching party were Capt. Moffat, Chief of Naval Aviation, members of the Senate and House Naval Affairs Committee and other distinguished persons.

These boats are the well-known Navy Coast Patrol flying boats which did such wonderful service in patrolling the entire Atlantic Coast and doing convoy work during the war.

The boats have been converted by the Aeromarine Company into six-seated open cockpit and six-seated enclosed cabin passenger boats, equipped with 400 horsepower Liberty motor and wing spread of 72 feet, speed of 75 miles per hour.

In launching the boat, Secretary Denby said that he considered it of a very real importance that our people became familiar with the present-day safety and the advantages of commercial aviation.

After the launching of the boat, Secretary Denby, together with officials of the Aeromarine Company, took a flight over Washington, circling around Washington Monument and then a flight down the river near historic Mt. Vernon.

This is the first time in history of the public that a Cabinet Member has taken such an important step to encourage commercial aviation and impress the people with the safety of flying.

Indianapolis-Chicago Air Service to Start

Indianapolis—Aerial transportation service between Indianapolis and Chicago started April 15, according to announcements by Dr. John K. Kingsbury of the Indianapolis Aero Association, for which a charter was filed in the office of secretary of state yesterday. John P. Koehler and Leslie Sanders are associated with Dr. Kingsbury. C. S. Crawford, formerly with Premier, has been elected a director.

Seaplanes Rescue Stranded Party

Miami, Fla.—After being stranded thirteen days on a little key off the Bahama Islands, inhabited only by a handful of natives and one white man, Webb Jay, a wealthy Chicago broker and sportsman, and party of four were rescued April 22 by seaplanes sent out to search for them. Tattered and torn, without a change of clothing since they left Miami almost three weeks ago, the party arrived here this afternoon with a thrilling tale of how they had lived almost entirely on fish, watching daily for some boat to appear to take them back to civilization.

Jay, his wife, Charles R. Deshiel, president of the Deshiel Motor Company of Chicago, his wife and a negro servant, put off from Miami about three weeks ago in a little speed boat, Sue J., for a pleasure trip to Bimini, in the Bahama Islands. The trip across, forty-five miles, was made without incident and the party started back a week ago Sunday in a rolling sea. Hardly seaworthy, the little Sue J., an open boat, found itself incapable of the task of battling the high waves and it tossed perilously about when it struck the open water.

At dawn April 22, three seaplanes, taking different routes, were dispatched to comb the coast and search the keys and crags of the islands. Shortly after noon one of the planes, circling low over Gun Cay, discovered a figure frantically waving a white rag from a tree top. Alighting in the water, the pilot made his way to the spot and was met by the stranded five.

Mayoralty Calls by Aeroplane

Hartford—Mayor Brainard, Corporation Counsel Schultz and Hiram Percy Maxim, chairman of the Municipal Aviation Commission of Hartford, were passengers April 23 in a six-seated naval aeroplane which made a trip from this city to Springfield, Mass., the flight requiring only twenty minutes, or one-third the time required to make the trip by train.

In Springfield they were greeted by Mayord Leonard and, after visiting municipal buildings and being welcomed by other Springfield officials, returned to Hartford in the same machine, the homeward trip taking twenty-three minutes, during which a heavy rainstorm was encountered.

So far as known, this is the first time a Mayor of one city has made use of an aeroplane to visit a Mayor of another city. Hartford will open its new municipal aviation field, the first of its kind in any Eastern city, in a few weeks.

Rumpler Visits America

Edmund Rumpler, director general of the Rumpler automobile and aeroplane works in Bavaria, arrived recently on the the Nieuw Amsterdam. He has come here on a business trip which will take him to the Pacific Coast. He was met at the pier by a large group of friends, and after consulting with them announced that he would make known his plans some time this week.

Rumpler, who is forty-nine years old, is regarded as one of the most prolifically creative minds in the automobile and aircraft business in Europe. He designed and built the first automobile in Germany, in 1897, and was identified with that industry until the outbreak of the war, when practically all his efforts were directed to the creation of German aeroplanes for war service.

He said he expected to inspect nearly all the big automobile plants of the country.

THE NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

Photograph taken at the White House after interview with the President, April 21, 1921, the occasion being the semi-annual meeting of the entire committee, following close upon the approval by the President and transmission to Congress of a special report of the Committee outlining a new national aviation policy. Reading from left to right: J. F. Victory, Assistant Secretary; Dr. M. I. Pupin, Columbia University; Orville Wright, Dayton, Ohio; Dr. Joseph S. Ames, Johns Hopkins University, Baltimore; Dr. William F. Durand, Leland Stanford Junior University, California; George W. Lewis. Executive Officer; Rear Admiral D. W. Taylor, Chief Constructor, U. S. Navy; Major T. H. Bane, Chief Engineering Division, Army Air Service; Dr. Charles D. Walcott, Chairman of Committee, Secretary of Smithsonian Institution; Major General Charles T. Menoher, Chiief of Army Air Service; Captain William A. Moffett, Director of Naval Aviation; Professor Charles F. Marvin, Chief of the Weather Bureau; Dr. S. W. Stratton, Secretary of Committee, Director of Bureau of Standards; Professor John F. Hayford, Northwestern University, Evanston, Illinois

Plan Use of River As Seaplane Route

Mobile, Ala.—To demonstrate the feasibility of the Warrior river as a route for seaplanes, a fleet of government planes will arrive in Mobile in the near future to make a trip to the river to Birmingham. Announcement that the attempt, which was planned last December, will be made was made by Lieutenant Commander Dibrell, navy recruiting officer of Alabama.

Government pilots made a survey of the Warrior river last December, and announced that the course was feasible for a seaplane route. When the government planes make the trip, Mobile will be more closely bound to the industrial district around Birmingham, it is believed by local shippers and exporters.

The exact date of the flight is not known. Arrangements are being made and it is believed, will be completed before the end of April.

Additional World Commissioners

The World's Board of Aeronautical Commissioners, Inc., has been increased to eighty-nine members representing seventy-one countries and colonies. The new members are as follows:—Bulgaria, Sofia, Stoyan Milosheff; Colombia, Bogata, Ulpiano A. de Valenzuela; Denmark, Copenhagen, Capt. H. C. Ullidtz; Finland, Helsingfors, Consul Ernst Krogius; Greece, Athens, Michael Leon Melas; New Brunswick, Rothesay, W. R. Turnbull, Esq., M. E. F. R. AeS.; Prince Edward Island, H. R. Stewart; Rumania, Bucarest, Lt. Col. A. Popovici; Spain, Madrid, Don Joequin de la Llave; Sweden, Stockholm, Secretary Svenska Aeronautiska Sallskapet; Transvaal, Johannesburg, Lt. Col. Vicomte Rene de Sarigny, O. B. E.

Planes to Seek for Oil in South America

Two seaplanes are leaving England soon to search for oil in South America. Managing Director Piniers of the British Controlled Oil Fields Company said recently that his firm is sending two flying-boats to survey the delta of the Orinoco River. He was enthusiastic at the prospects of the new venture.

"Accompanying the seaplanes," he added, "will be the biggest men in the scientific world whom we can obtain, and the best photographers. Photography will be all-important, for oil lands show a partly destroyed vegetation in parched ground, and the camera will reveal the areas which have this distinctive feature, the tributaries which run into the parent spring, and the forest roads and approaches which will be of use to us."

Aerial Mail in China

Representatives of the aeronautical department of the Pekin Government were in Shanghai through the first weeks of the new year to arrange for the erection of an aerodrome, and at that time it was announced that the proposed air mail service between Shanghai and the capital would be established by May 1.

Those actively in charge of the plans for the air mail service are Col. F. V. Holt, who was loaned to the Chinese Government by Great Britain and who holds the post of adviser to the aeronautical department, and Col. Tcheng Hung, chief of military affairs of the aeronautical department.

Aerodromes are to be established at Pekin, Tientsin, Tsinanfu, Huchowfu, Nanking and Shanghai, and a number of these were being erected in February. It is announced that if the air mail service proves successful after the first six months the aeronautical department will establish a passenger service from Shanghai to Pekin and it is also planned to establish air routes linking Shanghai to Pekin with Chunking and other centers in the remote interior in Szechuen province, and routes to Hongkong and to Canton also are being planned.

Synthetic Petrol: New German Process

Inasmuch as the fuel problem, in spite of present chances of a drop in prices, still is causing deep concern in German automobile and aviation circles, the recent invention of a very promising process for the manufacture of synthetic petrol is hailed with universal satisfaction.

It had so far been impossible to produce volatile fuel from heavy brown coal tar oils by decomposition or the like. Even the various splitting and hydration processes do not seem to have been introduced into industrial practice, no light brown coal fuel manufactured by this means having so far been put on the market. The Blumner process was already some time ago quoted in the German Trade Press, though it then was still at an experimental stage. A German chemist, Dr. Erwin Blumner, of Berlin-Wilmersdorf, had, in fact, succeeded in designing a method of preparing synthetical petrol from brown coal tar. This method has recently been patented, tests by Prof. Bunte, of Carlsruhe, having led to excellent results, and it is shortly to be applied on a huge scale in a former powder factory in the neighborhood of Munich. Though no chemical or engineering details can as yet be made known, this much can be said, that the process is greatly superior to any one of those previously devised, primarily because it in a remarkably simple manner—under low pressures and without any need for stirring—avoids the objectionable formation of coke. Even heavy brown coal tar oils are, under the influence of heat and high pressures, decomposed as it were, automatically into light hydro-carbons, yielding great quantities of suitable fuel. On account of the great cheapness of raw materials, the new type of fuel will be very cheap.

W. L. Hamilton, who has done some remarkable aerial photographic work for the Fairchild Aerial Camera Corporation

Las Vegas Aviation Club Forming

Bob Hausler, Director of landing fields in Nevada for the Aero Club of Southern California, informs us that progress is being made in the matter of establishing an aviation club in Las Vegas, Nevada. Mr. Hausler has recently been devoting considerable time to the establishing of a chain of landing fields in the State of Nevada and also on the airline between Salt Lake and Los Angeles. On this line he has already been successful in establishing fields at Lynndyl, Milford, Lund in Utah; Caliente, Dry Lake, Las Vegas, Roach in Nevada; Kelso, Yermo, Victorville in California.

Paris-Warsaw Aero Line Is Inaugurated

France has added another link to her chain of international aerial communications by the opening of a daily passenger and mail service between Paris and Warsaw.

The first trip was concluded safely. The journey was covered in less than ten hours, with a half-hour halt at Prague, where a passenger and baggage was taken on. It is impossible to make this journey by train under normal conditions in less than sixty hours.

The First Air Station Master

From his office in a big central tower perched on four legs high above the hangars and service buildings at Croyden, Major S. T. L. Greer, the first air station master in Great Britain—it is believed, the first in the world—will direct all arrivals and departures at that aerodrome.

Major Greer who, according to the London *Star*, has had wide experience in military and civil flying, will be charged with giving safe landing orders to all incoming machines, and thus prevent collisions on the aerodrome. By wireless he will be able to instruct an aeroplane on its way from Lympne, after crossing the channel from Paris, either to increase or slacken speed so that it does not collide with the arrival from Amsterdam, and "joy riders" lingering on the aerodrome must be hustled in order to insure clear landing space for approaching machines.

At night Major Greer will direct air traffic with rockets and Very lights. Far away over the Surry hills he will see the green light rise high in the sky—a night flier on the airway signalling for a landing at Croyden. The answer will be flashed back—a green light if the way is clear, or white if no landing space is available and the flier should defer his arrival till space can be made ready.

"It is all so matter of fact," says the *Star*, "this first air post in the world, so full of wonders locked up in innocent little houses beside the mighty hangars, that it is only when one gets behind the scenes that one realizes its outstanding features. A lighthouse to guide pilots lights and goes out automatically, its 72,000 candle-power beam visible from the air for thirty miles. Three powerful searchlights help with the night flying operations. Near by is a rocket apparatus for signalling. The old flares that used to indicate to night pilots the direction of the air currents—since a machine always lands head to wind—have been replaced by an ingenious landing light in the shape of a huge capital L. It is let into the ground, the electric bulbs being covered with glass safe for aeroplane to land upon. The upright arm of the L faces the direction in which the wind blows."

The AIRCRAFT TRADE REVIEW

1921 Spring Meeting of The American Society of Mechanical Engineers

The 1921 Spring meeting of The American Society of Mechanical Engineers is to be held in Chicago, May 23-26, at the Congress Hotel.

Well developed programs will be presented by the Professional Divisions of the Society devoted to Forest Products, Fuels, Machine Shop, Management, Material Handling, Power, Railroad, and a specially important session will be devoted to Training for Industries. The Chicago Committee, jointly with the Western Society of Engineers, is preparing a session on "Chicago as the Rail-Water Gateway."

Visits to a great number of points of engineering-interest in Chicago will be arranged. Special attention is being given to the co-relation of plant visits with the technical sessions.

En route to the meeting, the Society, jointly with the Society of Automotive Engineers, will stop at McCook Field on Saturday, May 21st, for an inspection of the facilities of the field.

McCook Field is the nucleus of the possibility of what might be called a national post-graduate research laboratory in areonautics. To those interested in this subject, the Field offers an opportunity for satisfying the mind as to the possible developments and future possibilities.

The opportunity of inspecting this Field is offered to The American Society of Mechanical Engineers and the Society of Automotive Engineers who will gather there on Saturday, May 21st, on the way to the Spring meeting of the A. S. M. E., and the Summer meeting of the S. A. E.

The facilities of the Field will be thrown open to the visitors and an exhibition of flying will be made. A social evening in Dayton is also being planned.

On May 27-28, the Friday and Saturday following the meeting, a joint excursion with the Army Ordnance Association will proceed to Rock Island Arsenal, where the Ordnance Division will present papers and enjoy an inspection of the plant. Saturday will be devoted to a handicap golf tournament on the Rock Island links.

Montreal's Two Pioneer Flying Concerns Amalgamated

The early spring weather finds flying already under way in Montreal. During the winter arrangements for a merger of the two pioneer flying organizations, the R. & W. Air Service and Canadian Aerial Services Limited, have been completed. The amalgamated concerns will operate under the name of Canadian Aerial Services Limited from the Public Customs Air Harbour at Lazard, near Cartierville, Island of Montreal. This Air Harbour is very nicely situated on the Canadian Northern Railway, main Ottawa line, and may be reached from the centre of the city by train in twenty minutes, and by street car in half an hour. It is very well equipped with an up-to-date workshop and a large Bessoneau hangar of the Air Force regulation type, materially strengthened to stand the rigor of the Canadian winters.

The staff of pilots includes A. Raymond, H. D. Wilshire, R. B. Daville, J. H. St. Martin and L. R. Charron, all of whom have had considerable experience in commercial flying. A. E. Walford, the secretary-treasurer, has made an extensive study of cost accounting, as related to aviation, and is in an admirable situation to look after the financial interests of the company at its offices in the Lake of the Woods Building.

The company at present owns six machines, and expects, in a very short time to obtain another one for operation. Their maintenance is under the supervision of R. W. Warner, in charge of engine repairs, and A. B. Smith in charge of rigging.

Contracts are now being closed for exhibition flying, aerial advertising, aerial photography and flying instruction.

Morton with Fairchild Camera Corp.

The Fairchild Aerial Camera Corporation has recently secured the services of Mr. E. R. Morton as Technical and Research Engineer.

Mr. Morton was formerly retained by the Science and Research Department of the United States Air Service at the Bureau of Standards, Washington, D. C., and Langley Field. He is given credit for developing the technique of testing camera mounts and for extensive experimental work leading to the scientific design of airplane camera mounting. The mounts for the Deram and K Cameras were the immediate results of his work and when tested at Langley Field, he determined the practical proof of the theory.

Mr. Fairchild and Mr. Morton have already cooperated on the design of both oblique and vertical mounts which will make it possible for inexperienced aerial photographers to secure perfectly sharp aerial views free from vibration.

Arkansas City Municipal Hangar

Arkansas City, Kansas.—A new municipal hangar was dedicated April 5th with a night-flying exhibition and aerial fireworks. This new hangar is 40 by 100 and houses a machine shop and repair department besides accommodating eight or ten planes. This hangar is located one mile north of the city and the field has been designated by the Government as a transcontinental landing field. It is said to be one of the finest fields in the Middle West. The Williams-Hill Airplane Company occupy the new hangar as their headquarters.

Air Service Bids

SCREW PLATES—Air Service, Munitions Bldg., Washington.—Bids are wanted until 2:30 p. m., May 4, circular 74, for furnishing 200 sets single stock screw plates. For information address above.

ENGINE PARTS—Engineering Division, Air Service, McCook Field, Dayton, Ohio.—Bids are wanted until May 6, circular 21228, for furnishing miscellaneous spare parts for Wright engine. for information address above.

WRENCHES—Procurement Branch Air Service. Munitions Bldg., Washington.—Bids are wanted until 3 p. m., May 3, circular 79, for furnishing large quantities of pipe and adjustable wrenches. For information address above.

AIRPLANE BOLTS—Engineering Division, Air Service, McCook Field, Dayton, Ohio.—Bids are wanted until May 3, circular 21226, for furnishing large quantities of airplane bolts. For information address above.

CHISELS—Procurement Branch, Air Service, Munitions Bldg., Washington.—Bids are wanted until 2:30 p. m., May 3, circular 73, for furnishing large quantities of chisels. For information address above.

The April Class at the Ralph C. Diggins School of Aviation at Chicago

THE RESISTANCE OF AEROFOILS

By W. F. GERHARDT

Aeronautical Engineer, McCook Field

(Continued from last week)

Definitions

THE foregoing laws of air resistance are without definite meaning unless rigid and consistent definitions are given to the fundamental quantities involved. Neglect of this important fact has led to many inconveniences in the past.

The Angle of Attack

The "angle of attack" is the angle included between the reference line LL and the direction of the velocity V. LL was chosen up to this point arbitrarily, for purposes of discussion. If all aerofoils were of the same cross-section one line would be as good as another, but in the comparison of aerofoils of different cross-section, the question of a standard becomes of first importance.

In the development of aviation it has happened unfortunately that the "chord" has been adopted as reference line. It probably came about through the fact that a definite geometrical chord existed for the aerofoils used in most early machines. For example, the chord of the aerofoil of Fig. 7-a is the common chord of the curves that limit the profile. What, however, is the chord of such an aerofoil of Fig. 7-b? It is evident that almost any line can with equal success be called that chord, and it is impossible to say when two profiles of this type have equal angles of attack.

When dealing with the flat plate we have no difficulty in fixing the reference line (Fig. 8); it is the plate itself and the angle of attack is the angle included between the plate and the direction of the velocity. But what is the aerodynamical characteristic that guides us in the selection? It is nothing more than the direction for which the air resistance R_0 lies in the same direction as the velocity, V_0—the lift is zero. The plate itself is the zero lift direction.

Consider any aerofoil (Fig. 9) on which the air blows successively from the directions V^4, V^3, etc., that is, under decreasing angles of attack, and let R^4, R^3, etc., be the air resistances corresponding to these orientations. When the angle of attack reaches a certain value, R_0 lies in the same direction as V_0, just as in the case of the flat plate, but for the aerofoil the air must blow on the upper surface.

It is easy to see that for each aerofoil there are four zero lines, that is, there are four orientations which give zero lift. For aeroplane performance, the "standard zero line" of Fig. 9 only is of interest. The plane perpendicular to the plane of symmetry including the "zero line" is the "zero plane."

It is obvious, therefore, that the reference line LL must be made the "zero line," and the angle of attack i measured from it. The angle of attack as measured from the famous chord, i_1, is less than i by the angle i_0 constant for each aerofoil. (Fig. 6.)

It has been charged that the "zero line" cannot be directly measured experimentally. This question of an experimental reference line is altogether a different matter, and must be decided by the technique of the particular experiment. In one case one line, in another case another line, may be more convenient.

The Aerofoil Area

The aerofoil area needs special definition. Inasmuch as the zero plane is the only reference plane definitely determined for each aerofoil, the specification that must be given the area is that it is the projection of the aerofoil on the zero plane. Usually this area is not appreciably different from the area projected on the plane of the chord, when such exists, but only by the former specification can indeterminations be avoided.

The Density

The density needs no definition. It is well to remark in passing, however, that while its expresion in specific weight units (pounds/foot^3) is correct, yet mass density units are more convenient (pounds x seconds^2/feet^4), for then the coefficients in the fundamental formula are put in the absolute system, that is, independent of units, and can be reapplied to any other self-consistent system of units.

The Velocity

The velocity which enters into relations (3) and (4) is, in the usual case of an aerofoil disposed in a wind tunnel of con-

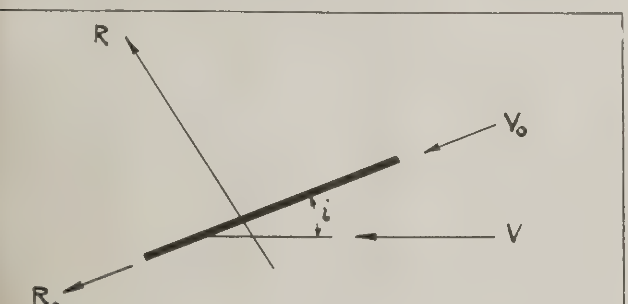


FIG. 7 — THE REFERENCE LINE FOR THE FLAT PLATE

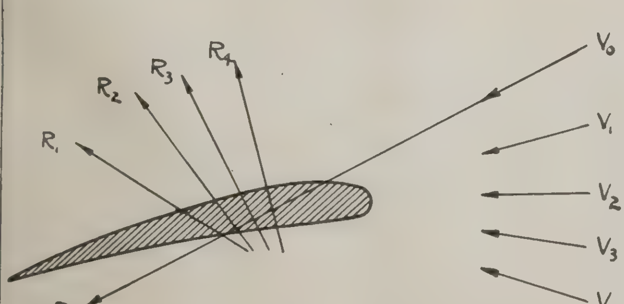


FIG 8 — THE REFERENCE LINE FOR THE AEROFOIL

FIG 9 THE INDETERMINATION OF THE GEOMETRICAL CHORD

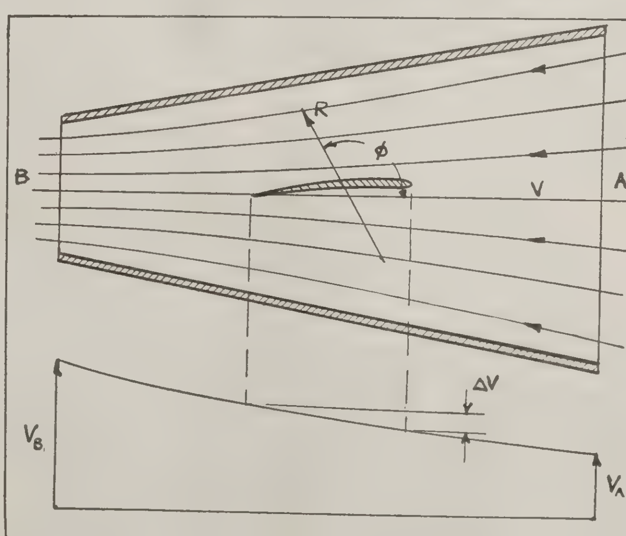


FIG. 10 — THE VELOCITY OF REFERENCE FOR THE PROPELLER CASE

stant cross-section, the velocity of the current itself. It is determined by measuring the velocity of that current in front of the aerofoil where the disturbance of the flow due to the presence of the body is not felt. This distance is usually about twice the breadth of the aerofoil.

The same is true for the aeroplane in free flight. In the case of the propeller the conditions are more complex.

The elementary sections of the blade are considered as small aerofoils working in a current of air, which, on account of the inflow velocity, is increasing continuously in magnitude as it approaches and passes the blade. There is such a position in front of the body where the flow is undisturbed by the aerofoil, but it is not uniform there. It is much as if the aerofoil were disposed in a conical wind tunnel. (Fig. 10.)

This case requires a generalization of the laws of fluid resistance. The criterion is the energy balance. If E is the energy absorbed by the stream from the body and is the angle included between the air reaction $\overline{R}$ and the mean flow direction $\overline{V}$, then

$$E = RV \cos \Phi \tag{6}$$

and

$$V = \frac{E}{R \cos \Phi}$$

It is just the energy relation that Dr. de Bothezat uses in his propeller investigations * for the determination of the speed V.

* "General Theory of Blade Screws," Dr. Geo. de Bothezat, N. A. C. A., page 27.
"Some Remarks Concerning the Fundamentals of the Blade Screw Theory," Dr. Geo. de Bothezat, "Aeronautical Journal," Nov., 1920.

The Center of Pressure

Having specified the quantities in the relations which fix the magnitude and orientation of the air resistance, we must next give a meaning to the center of pressure relation, which determines the position of $\overline{R}$. It is immediately evident that to be consistent with the standpoint already adopted we must use as the point C the intersection of R with the zero line. The advantages of this system will at once be apparent.

Imagine that the air blows successively on the aerofoil from the directions V_5, V_4, V_3, etc., causing the air resistances R_5, R_4, R_3, etc. (Fig. 11), as previously considered. Suppose that the center of pressure be taken as the points 5, 4, 3, 2, etc., on the chord. We easily see that for a certain angle of attack corresponding to V_1, the air resistance is going to be parallel to the chord. At this angle the intersection of center of pres-

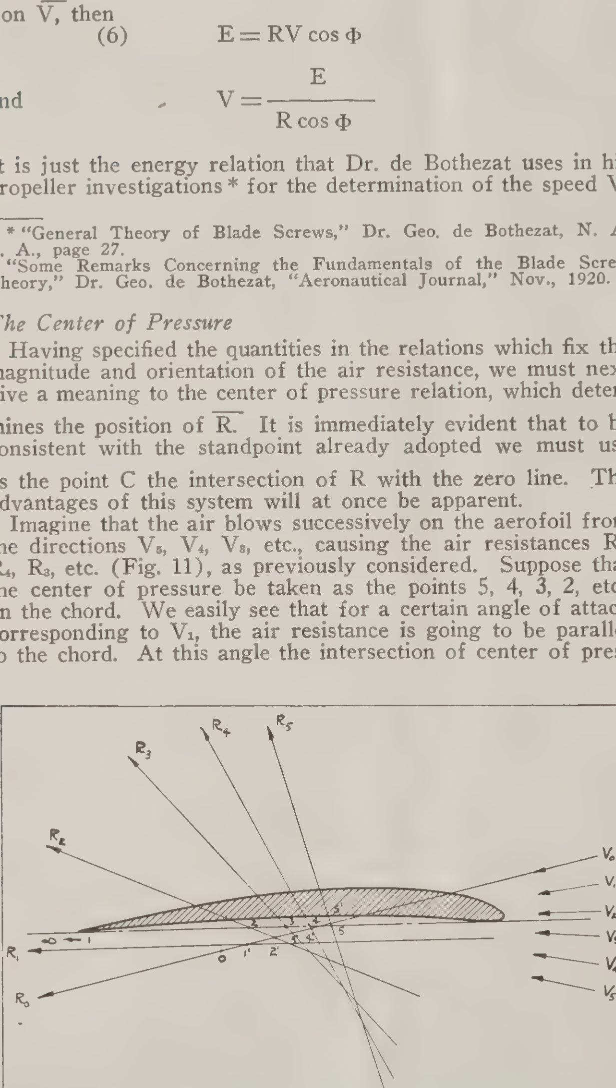


FIG. 11 — THE CENTER OF PRESSURE TAKEN ON THE CHORD AND ON THE ZERO LINE

sure (1) is at infinity. The travel of point C on the chord or the distances l is represented graphically, in Fig. 12, and is characteristic of all aerofoils. l is plotted in function of i.

When, however, the point C is located on the zero line the center of pressure travel is finite points 5^1, 4^1, 3^1, 2^1, 1^1, 0^1. Letting l^1 be the distance from the leading edge, we get the graph of Fig. 13. The reason for the limited travel of center of pressure will be evident from the following discussion of the center of parallel forces and metacentric curve.

Consider two forces F_1 and F_2 of constant magnitude applied through points 1 and 2 (Fig. 14). As is well known, the resultant force $R_{1,2}$ will divide the distances 1 and 2 in inverse ratios of the force F_1 and F_2. If we consider the forces F_1 and F_2 turning around the points 1 and 2, but remaining parallel and constant in magnitude, the resultant $R_{1,2}$ will also

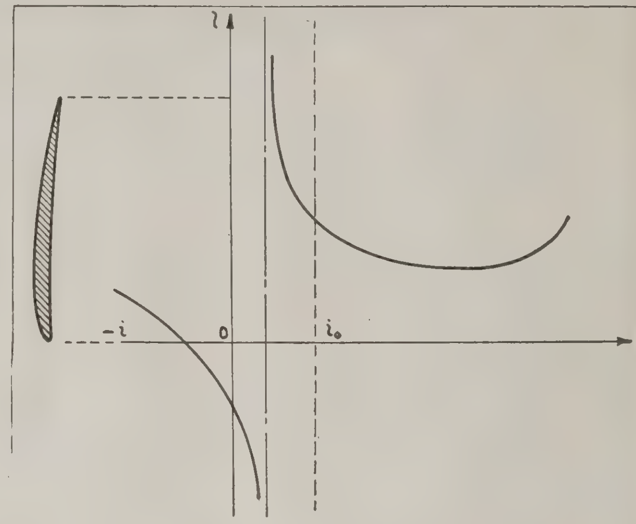


FIG. 12 — CENTER OF PRESSURE TAKEN ON THE 'CHORD'

turn around a point I. If we increase the number of forces to three, F_1, F_2, and F_3, the resultant $R_{1,2,3}$ will also turn around a point II and so on for any number of forces. The point about which the resultant of a system of constant and parallel forces turns when the individual forces turn around points is called the "center of parallel forces." The center of gravity is a particular case of the center of parallel forces, where the forces considered are the weights of the individual elements of the body.

Consider now *any* system of forces acting in a plane, which do not remain constant and parallel and turn about points, but vary continuously in magnitude direction and position. In this more general case the resultant force will vary in position and magnitude, taking up the successive positions shown in Fig. 15, and describing the curve called the "metacentric curve." The center of parallel forces is a particular case of the metacentric curve reduced to a point.

The system of forces acting on the aerofoil describe a metacentric curve in the plane of symmetry (Fig. 16). A very valuable property of this curve is that it has a cusp, the point where the zero line is its tangent.

If we take the center of pressure as the intersection of R with the zero line it is at once evident that the limiting rearward position of the intersection is the cusp point (Fig. 16).

The center of pressure is neither a metacenter nor a center of parallel forces but is merely an arbitrary method of fixing the position of R, and hence its choice should be guided solely by convenience. The selection which gives an asymptotic curve as graph is far from being a wise one.

The Fictitious Equivalent Plane

From the above considerations it is apparent that the projection of the aerofoil on the "zero plane" can be taken to represent the properties of the aerofoil and is a very convenient conception. The angle of attack, area, and the center of pressure movement of the real aerofoil are the same as for the equivalent plane. It only remains to ascribe to the plane the k_x's and k_y's which the real aerofoil possesses. This plane

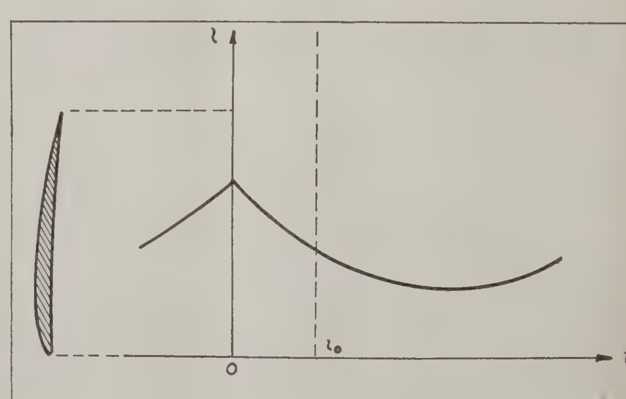


FIG 13 — CENTER OF PRESSURE TAKEN ON THE ZERO LINE

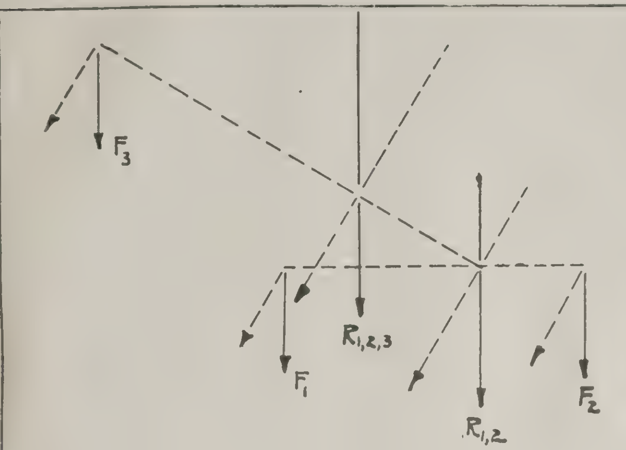


FIG. 14 — THE CENTER OF PARALLEL FORCES

FIG. 15 — THE METACENTRIC CURVE

fully replaces the actual aerofoil and is called the "Fictitious Equivalent Plane." For the convenience in usage of this conception, see the stability paper above referred to.

General Data on Aerofoils

The actual behavior of the aerofoils in use under flying conditions is as follows:

For angles of attack within the flying range for which aerofoils are used the lift is zero when the wind is blowing on the back of the aerofoil, as we have observed. It must also be noted that the zero lift ine passes somewhat above the aerofoil.

Starting from zero absolute incidence, the air resistance rises quickly out of the zero plane, so that for angles of attack of 5° or upwards, it makes small angles with normal to the zero lift line.

Within this range the lift coefficient is very closely proportional to the angle of attack:

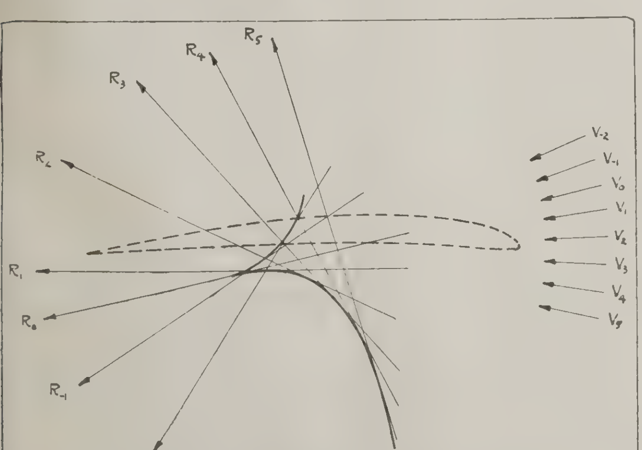


FIG. 16 — THE METACENTRIC CURVE OF THE AIR FORCES SHOWING CUSP.

(7) $$k_y \cong ki$$

(8) $$R_y \cong k\delta AV^2 i$$

while the drag follows a parabolic law:

(9)[1] $$k_x = k\,(ai^2+6i+c)$$

or since b is usually quite small:

(9) $$k_x = k\,(ai^2+c)$$

(10) $$R_x = k\delta AV^2\,(ai^2+c)$$

The value of k depends greatly on the aspect ratio, and for the practical ratios of around 6 it is about .

For ordinary aerofoils, as the angle of attack increases from zero, the center of pressure first approaches the leading edge and only for relatively large angles, travels to the rear. This is the "instability of the single aerofoil."

Characteristic Curves of Aerofoils

There are several methods in use for the representation of the characteristics of the aerofoils, any one of which may be deduced from any other.

The *first method* consists in the plotting of the values of β and ki in function of the angles of attack i. The general shape of the curves is as represented in Fig. 17. For angles above 5°,

(11) $$k_1 \cong k_y = ki$$

and by trigonometry,

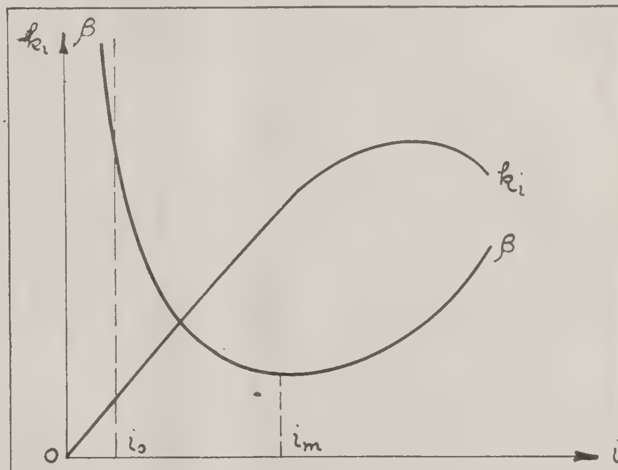


FIG. 17 — FIRST METHOD OF PLOTTING AEROFOIL CHARACTERISTICS

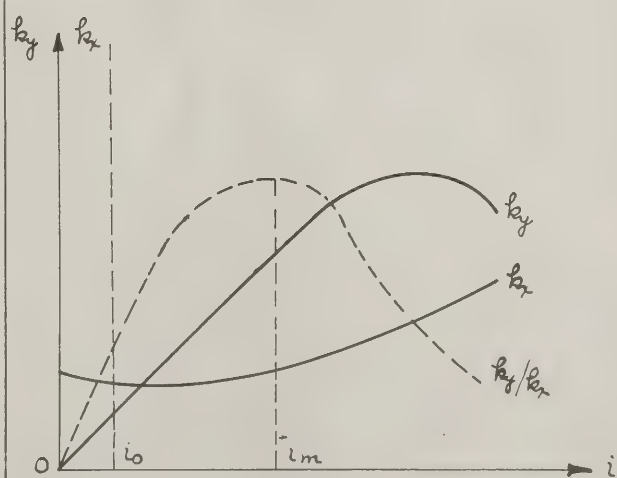


FIG 18 — SECOND METHOD OF PLOTTING AEROFOIL CHARACTERISTICS

$$\beta \cong \frac{k_x}{k_x} \cong \frac{k\,(ai^2 + c)}{ik}$$

$$(12) \qquad \beta \cong ai + \frac{c}{i}$$

The *second method* is in common use; kx and ky are plotted in function of i with ky/kx as auxiliary information (Fig. 18).

$$(7) \qquad k_y = ki$$

$$(9) \qquad k_x = (ai^2 + c)\,k$$

In both the above systems

$$l = f_2\,(i)$$

of Fig. 13 must be added.

The *third method,* which was first introduced by Eiffel, and has been of the greatest value in investigation work, is shown in Fig. 19. kx is plotted in function of ky; angles of attack i are marked on the curve. The angle β can be read directly by joining the point corresponding to the angle of attack i_1 in question with the origin. The kx/ky curve is sometimes added for the purpose of performance analysis.

From the foregoing empirical relations we see that the drag is a parabolic function of the lift, for,

$$(9) \qquad k_x \cong k\,(ai^2 + c)$$

but

$$i = \frac{k_y}{k}$$

Hence

$$k_y = k\left(a\frac{k_y^2}{k^2} + c\right)$$

$$= \frac{a}{k}k_y + ck$$

and

$$(13) \qquad k_x = rk_y^2 + s$$

$$(14) \qquad k_x/k_g = rk_g + \frac{s}{k_y}$$

The drag formula will be shown to have a sound theoretical foundation from a consideration of the drag due to tip vortices.

The Germans at Goettingen have used this system exclusively in publishing the results of their recent investigations,* and have, in addition, introduced a novel method of representing the center of pressure. The moment of the coefficient ki about the leading edge of the aerofoil is plotted in function of ky. This function turns out to be a straight line (within the flying range of angles of attack) passing through the origin (Fig. 19).

$$(15) \qquad M = M \cong k_i r$$
$$= C_1 + C_2 k_y$$

and since it is also true within the flying range that

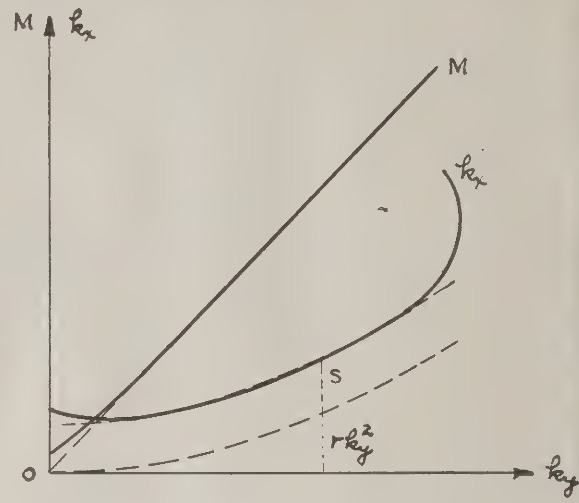


FIG. 19 — THIRD METHOD OF PLOTTING AEROFOIL CHARACTERISTICS

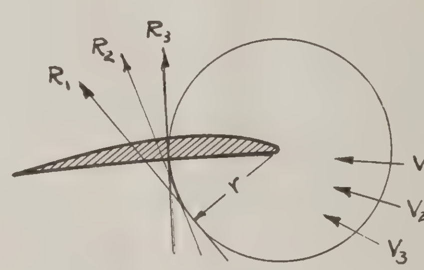


FIG 20 — GEOMETRICAL INTERPRETATION OF THE CENTER OF PRESSURE MOVEMENT.* SUGGESTED BY DR. DE BOTHEZAT.

$$(11) \qquad ki \cong ky$$

it follows that

$$(16) \qquad r \cong c$$

Geometrically interpreted,** it states that the resultant air force vector lies within these limits on a circle of radius r = c the center of which is at the leading edge of the aero foil (Fig. 20).

* See "Technische Berichte," Vol. I.
** Dr. de Bothezat.

SPECIAL REPORT OF THE NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

Federal Regulation of Air Navigation—Air Routes to Cover the Whole United States—Co-operation Among Government Departments

On April 1, President Harding wrote Dr. Walcott, Chairman of the National Advisory Committee for Aeronautics, requesting that he "immediately organize a sub-committee of the National Advisory Committee for Aeronautics, with representatives from the War, Navy, Post Office and Commerce Departments, and civil life; that the sub-committee take up vigorously and fully the question of Federal regulation of air navigation, air routes to cover the whole United States, and co-operation among the various departments of the Government concerned with aviation, reporting:

a. What can and should be done without further legislative action;

b. What legislative action and appropriations are necessary to carry into effect the recommendations of the sub-committee?"

On April 9, Dr. Walcott submitted his report to the President, and on April 19, the President transferred it to Congress with the following letter:

"I transmit herewith for the consideration of the Congress a special report of the National Advisory Committee for Aeronautics, prepared at my request and dealing with Federal regulation of air navigation, air routes to cover the whole United States, and co-operation among the various departments of the Government concerned with aviation.

"The attention of the Congress is invited to the statement of general considerations on a national aviation policy, and to

the committee's recommendations for legislative action, which have my approval."

The report from Dr. Walcott to the President is as follows:

Dear Mr. President:

In accordance with your letter of April 1, 1921, addressed to Dr. Charles D. Walcott, Chairman of the National Advisory Committee for Aeronautics, this Committee organized a special Sub-committee on Federal Regulation of Air Navigation, as follows:

War Department:
Major General C. T. Menoher, U. S. A.
Major W. G. Kilner, U. S. A.

Navy Department:
Rear Admiral D. W. Taylor, U. S. N.
Commander Kenneth Whiting, U. S. N.

Post Office Department:
Mr. E. C. Zoll,
Mr. C. I. Stanton.

Department of Commerce:
Dr. S. W. Stratton,
Mr. E. T. Chamberlain.

Representatives from Civil Life:
Mr. Sidney Waldon,
Mr. F. H. Russell,
Mr. Glenn L. Martin.

Dr. Charles D. Walcott, Chairman,
Mr. J. F. Victory, Secretary.

This sub-committee has taken up, as you directed, the question of Federal regulation of air navigation, air routes to cover the whole United States, and co-operation among the various departments of the Government concerned with aviation, and, in addition, the two questions specified in your letter:

"a. What can and should be done without further legislative action;

"b. What legislative action and appropriations are necessary to carry into effect the recommendations of the sub-committee?"

The report of this sub-committee is as follows:

The following general consideration on a national aviation policy are recommended:

1. Aviation is inseparable from the National Defense. It is necessary to the success of both the Army and the Navy. Each should have complete control of the character and operations of its own air service.

2. Aeronautics is a comparatively new science capable of such tremendous and rapid development that it is of vital importance, in time of peace, to make the greatest possible progress in the science itself. Everything should be done to stimulate invention and to encourage the practical use of air-craft of all kinds and of all the equipment and appliances necessary or incidental thereto.

3. It is considered impracticable in time of peace to maintain a large armed air force, but it is considered imperative that we maintain a sufficient nucleus of available personnel, including organized reserves, and of adequate equipment of the most modern type as a foundation upon which to build at the outbreak of war.

4. It is essential that commercial aviation be fostered and encouraged in harmony with the military and naval aviation policies and programs. The development of aviation as a whole will be made with the minimum of expense of the Government through the adoption of a wise and constructive policy for the up-building of commercial aviation.

5. The Air Mail Service is an important initial step in the development of civil and commercial aviation. It must be mantained and extended as rapidly as possible, not only to carry the mails, but to become a potential war reserve.

6. It is a pressing duty of the Federal Government to regulate air navigation; otherwise independent and conflicting legislation by the various states will be enacted and hamper the development of aviation. For this purpose, a Bureau of Aeronautics should be established in the Department of Commerce, by legislation similar to the Kahn Bill as modified (see draft of bill taken from Sixth Annual Report of the National Advisory Committee for Aeronautics, Appendix A).

7. Approved policies with respect to the encouragement and development of commercial aviation should be carried out by the Department of Commerce.

8. The Army Air Service should be continued as a coordinate combatant branch of the Army. Its existing organization should be used in co-operation with the Navy, Post Office, and other governmental agencies in the prompt establishment of national continental airways and in co-operation with the states and municipalities in the establishment of local airdromes, landing fields, and other necessary facilities.

9. The Naval Air Service and the control of naval activities in aeronautics should be centralized in a Bureau of Aeronautics in the Navy Department.

10. The continuous prosecution of scientific research in aeronautics is now provided for by the National Advisory Committee for Aeronautics, established by law in 1915, and broad questions of policy regarding the co-ordination of the activities of all governmental agencies concerned with aeronautics should be referred to that committee for consideration and recommendation.

11. The National Advisory Committee for Aeronautics should have authority to recommend to the heads of the departments concerned on questions of policy regarding the development of aviation, and to recommend to departmental heads desirable undertakings or developments in the field of aviation. To provide for the more effective discharge of these functions, the chief of the Air Mail Service of the Post Office Department and the chief of the proposed Bureau of Aeronautics in the Department of Commerce should be members of the committee.

12. Under this policy, there would be:

An Army Air Service under the Secretary of War;

A Naval Air Service under the Secretary of the Navy with its activities centralized in a Bureau of Aeronautics in the Navy Department;

An Air Mail Service under the Postmaster General;

A Bureau of Aeronautics for the regulation of air navigation, under the Secretary of Commerce, and for carrying out such policies as may be adopted for the encouragement and up-building of civil and commercial aviation;

A National Advisory Committee for Aeronautics for the continuous prosecution of scientific research in aeronautics, and, in an advisory capacity, the coordination of all aeronautical activities of the Govment.

Referring specifically to the detailed questions under the three headings, namely:

1. Federal Regulation of Air Navigation,
2. Air Routes to Cover the Whole United States,
3. Co-operation among the Various Departments of the Government Concerned with Aviation,

the committee reports as follows:

1. FEDERAL REGULATION OF AIR NAVIGATION.

(a) Federal regulation of air navigation cannot be accomplished under existing laws. Smuggling and other illegal uses of air-craft can be prevented in a measure.

(b) It is recommended that a Bureau of Aeronautics be established in the Department of Commerce (substantially along the lines of the Kahn Bill as modified) for the regulation of air navigation and for carrying out such policies as may be adopted for the encouraging and up-building of civil and commercial aviation and that an estimate of $200,000 be submitted for the fiscal year 1922.

2. AIR ROUTES TO COVER THE WHOLE U. S.

(a) The Post Office Department is specifically authorized to establish an air route between New York and San Francisco. There is some question as to whether existing laws permit it to establish other routes.

The Army has no specific authority of law to establish air routes, but has chartered seven important main airways as follows:

1. One route from Augusta, Me., to Camp Lewis, Washington;
2. One from Washington, D. C., to San Francisco, Cal.;
3. One from Savannah, Ga., to San Diego, Cal.;
4. One from Augusta, Me., to Miami, Fla.;
5. One from Camp Lewis, Washington, to San Diego, California;
6. One from Laredo, Texas, to Fargo, N. D.;
7. One from Chicago, Ill., to Baton Rouge, La.

(b) In order to enable the Army to carry forward its program of air routes to cover the whole United States, it is recommended that an appropriation of $2,000,000 be made available during a period of two years.

Attention is drawn to "Necessary Aerological Service and Estimate of Costs," Appendix C. It is recommended that such portions of the appropriations asked for as are necessary to give aerological service on the approximately 4,000 miles of air mail routes now in commission be made available, and that the funds to cover additional stations along the national continental air routes to cover the whole United States be made available as fast as the need is indicated by the Army and the Post Office Department.

It is recommended that legislation be enacted which

will definitely authorize the Post Office Department to establish air mail routes between Chicago, Minneapolis, and St. Paul, and between Chicago and St. Louis, and such other air mail routes as may be determined by the Postmaster General as the need for them arises, taking full advantage, wherever practicable, of existing or contemplated airways.

3. CO-OPERATION AMONG THE VARIOUS DEPARTMENTS OF THE GOVERNMENT CONCERNED WITH AVIATION.

(a) Co-operation among the air services of the Army, Navy, and Post Office, with the Coast and Geodetic Survey, Bureau of Fisheries, Coast Guard, Weather Bureau, Geological Survey, and Forest Patrol Service, is being carried on with excellent results, as shown in Appendix D.

It is recommended that the President direct the National Advisory Committee for Aeronautics to appoint a sub-committee composed of representatives of the War, Navy, Post Office, and Commerce Departments, and two civilians representing the aircraft industry, who shall survey the engineering and production facilities of the aircraft industry and shall recommend a policy calculated to sustain and develop the industry to meet the needs of the Government.

(b) Attention is drawn to the memorandum on forest fire patrol, Appendix E. It is recommended that the funds ($217,151.00), and personnel asked for be made available for the purpose specified.

In summing up this report, permit me to emphasize the immediate need of legislation to provide for:

1. A Naval Air Service under the Secretary of the Navy, with its activities centralized in a Bureau of Aeronautics in the Navy Department.
2. A Bureau of Aeronautics under the Secretary of Commerce for the regulation of air navigation and the encouragement and up-building of civil and commercial aviation.
3. The development of a system of national continental air routes to cover the whole United States and to include the meteorological service essential thereto.
4. The extension of the Air Mail Service.
5. Making the chief of the Air Mail Service and the chief of the proposed Bureau of Aeronautics of the Department of Commerce members of the National Advisory Committee for Aeronautics.

Respectfully submitted,
NATIONAL ADVISORY COMMITTEE
FOR AERONAUTICS,
(Signed) C. D. Walcott, *Chairman.*

The President,
The White House
Washington, D. C.

Appendixes

A. Draft of Modified Kahn Bill (Ref. Page 2, Par. 6).*

B. Continental Airways and Approximate Costs (Ref. Page 5).

C. Necessary Aerological Service and Estimate of Costs (Ref. Page 5).

D. Co-operation among the various Departments of the Government concerned with Aviation (Ref. Page 6).

E. Co-operation of War and Agricultural Departments and Operating Cost of Forest Fire Patrol (Ref. Page 6).

*Appendix A is the modified Kahn Bill as shown on Pages 11-14 of Sixth Annual Report, National Advisory Committee for Aeronautics, and is not reproduced here.

APPENDIX B

Continental Airways and Approximate Costs.

By Air Service of the Army

Seven important main airways have been chartered, and by utilizing Government airdromes already existing, these airways make the air net complete for the United States.

One route from the State of Maine to the State of Washington covers the following stations:

Augusta, Maine—Municipal.
Plattsburg, N. Y.—Government, not A. S.
Binghamton, N. Y.—Municipal.
Buffalo, N. Y.—Private.
Cleveland, Ohio—Private.
Detroit, Michigan—Air Service.
Bryan, Ohio—Municipal.
Chicago, Illinois—Government, not A. S.
Winona, Minnesota—Municipal.
St. Paul, Minnesota—Government, not A. S.
Fargo, North Dakota—Municipal.
Portal, North Dakota—Municipal.
Miles City, Montana—Government, not A. S.
Missoula, Montana—Municipal.
Spokane, Washington—Private.
Camp Lewis, Washington—Government, not A. S.

One trans-continental route from Washington, D. C., to San Francisco, California:

Bolling Field, Anacostia, D. C.—Air Service.
Moundsville, West Virginia—Municipal.
Dayton, Ohio—Air Service.
Speedway, Indianapolis, Ind.—Air Service.
Rantoul, Illinois—Air Service.
Des Moines, Iowa—Municipal.
Omaha, Nebraska—Government, not A. S.
Hastings, Nebraska—Municipal.
St. Paul, Nebraska—Municipal.
Cheyenne, Wyoming—Government, not A. S.
Rawlins, Wyoming—Municipal.
Salt Lake City, Utah—Municipal
Elko, Nevada—Municipal.
Sacramento, California—Air Service.
San Francisco, California—Air Service.

One route from Savannah, Ga., to San Diego, Cal.:

Savannah, Georgia—Municipal.
Camp Benning, Georgia—Air Service.
Montgomery, Alabama—Air Service.
Baton Rouge, Louisiana—Municipal.
Lake Charles, Louisiana—Municipal.
Houston, Texas—Air Service.
San Antonio, Texas—Air Service.
Del Rio, Texas—Air Service.
Sanderson, Texas—Municipal
El Paso, Texas—Government, not A. S.
Douglas, Arizona—Government, not A. S.
Tucson, Arizona—Municipal.
Phœnix, Arizona—Municipal.
Yuma, Arizona—Government, not A. S.
San Diego, California—Air Service.

One route north to south on the Atlantic Coast:

Augusta, Maine—already mentioned.
Boston, Massachusetts—Municipal.
Mitchel Field, Lond Island—Air Service.
Bustleton, Pennsylvania—Government, not A. S.
Aberdeen, Maryland—Air Service.
Baltimore, Maryland—Municipal.
Washington, D. C.—Air Service.
Langley Field, Virginia—Air Service.
Camp Bragg, North Carolina—Air Service.
Camp Jackson, South Carolina—Air Service.
Savannah, Georgia—already mentioned.
Jacksonville, Florida—Government, not A. S.
Daytona, Florida—Municipal.
Carlstrom Field, Florida—Air Service.
Miami, Florida—Air Service.

One route along the Pacific Coast:

Camp Lewis, Washington—already mentioned.
Portland, Oregon—Municipal.
Red Bluffs, California—Government, not A. S.
Sacramento, California—already mentioned.
Fresno, California—Private.
Riverside, California—Air Service.
San Diego, California—already mentioned.

One middle route from north to south:

Larado, Texas—Air Service.
San Antonio, Texas—already mentioned.
Dallas, Texas—Air Service.
Waco, Texas—Municipal.
Wichita Falls, Texas—Municipal.
Post Field, Oklahoma—Air Service.
Little Rock, Arkansas—Municipal.
Tulsa, Oklahoma—Private.
Leavenworth, Kansas—Government, not A. S.
Omaha, Nebraska—Government, not A. S.
Aberdeen, South Dakota—Municipal
Fargo, North Dakota—already mentioned.

One route from the Lakes to the Gulf:

Chicago, Illinois—already mentioned.
Chanute Field, Rantoul, Illinois—Air Service.
Belleville, Illinois—Air Service.
Millington, Tennessee—Air Service.
Jackson, Mississippi—Municipal.
Baton Rouge, Louisiana—already mentioned.

In the establishment of these airways, it is found that the various municipalities are usually glad to contribute the actual landing fields if the Federal Government will furnish the necessary equipment to operate such a field. The installation provided will depend largely upon the number of Reserve

personnel in the immediate vicinity that would rely upon this installation for their flying training.

The type of installation is as follows:

1 Wing cone with proper support and field marker T	$ 150 00
1 Well with pump, 100 gallon tank	1,000 00
1 Building 25'x100' to contain the field office lockers meteorological office and emergency hospital and for use as a machine shop, supply storage and work-room	25,000 00
1 Oil tank, approximately 500 gallons, with pump	750 00
1 Oil house, ten feet square	850 00
1 Gas tank with approximately 1,000 gallons capacity, with pump	1,000 00
1 Hangar, steel, size 66'x120' with steel folding or sliding doors and cement floors	35,000 00
	$63,750 00

It will be noted that in this type installation only one hangar is furnished. In many cases it will be necessary to have at least three hangars. In centers like Philadelphia and Boston this means the addition of $70,000 to the above amount.

It is estimated that to establish completely this proposed net would cost approximately $2,000,000. In the estimate for the fiscal year, 1922, there was requested $1,000,000 as a start on this proposed scheme. It was desired to begin with the most important centers such as Boston, Philadelphia, Baltimore, Chicago, St. Paul, Minn., Denver, Col., Kansas City, and Seattle, Washington.

APPENDIX C

Necessary Aerological Service and Estimate of Costs.

A rational development of any program of navigation of the air must recognize meteorology and weather forecasting as a fundamental factor of great importance. The Weather Bureau was originally created by Joint Resolution of Congress approved February 9, 1870, placing the organization under the Chief Signal Officer of the Army, in the War Department, where it remained and developed for a period of about 20 years.

Organic Act

The Joint Resolution was superseded by legislation entitled:

"An Act to increase the efficiency and reduce the expenses of the Signal Corps of the Army, and to transfer the Weather Service to the Department of Agriculture." (Act October 1, 1920, c. 1266, 266 Stat. 653.)

This organic act became effective July 1, 1891, and defines and outlines the functions and duties of the Weather Bureau very comprehensively and fully in the following language:

"Sec. 3. That the Chief of the Weather Bureau, under the direction of the Secretary of Agriculture, on and after July first, eighteen hundred and ninety-one, shall have charge of the forecasting of weather, the issue of storm warnings, the display of weather and flood signals for the benefit of agriculture, commerce, and navigation, the gauging and reporting of rivers, the maintenance and operation of sea coast telegraph lines and the collection and transmission of marine intelligence for the benefit of commerce and navigation, the reporting of temperature and rainfall conditions for the cotton interests, the display of frost and cold-wave signals, the distribution of meteorological information in the interests of agriculture and commerce, and the taking of such meteorological observations as may be necessary to establish and record the climatic conditions of the United States, or as are essential for the proper execution of the foregoing duties."

With the practical development of navigation of the air a new demand was at once made upon the Weather Bureau for service in aid of aviation and it is construed that the words of the organic act "for the benefit of agriculture, commerce and navigation" obviously includes navigation of the air as well as of the oceans and inland waterways. Congress itself has in effect subscribed to this construction of the law, because in 1917 an appropriation was made for the conduct of this work under the following language:

"For the establishment and maintenance by the Weather Bureau of additional aerological stations, for observing, measuring, and investigating atmospheric phenomena in the aid of aeronautics, including salaries, travel, and other expenses in the city of Washington and elsewhere."

This appropriation was first included in the act making appropriation for the support of the Army for the fiscal year ending June 30, 1918, and has subsequently been continued in the annual appropriation bills for the Weather Bureau of the Department of Agriculture.

Authority of Law Now Adequate

It is believed the foregoing completely establishes that the Weather Bureau has full existing authority of law for the conduct of meteorological work of every character required for aeronautics, and under these laws the Bureau has been conducting as large a program of work as is possible with the funds available.

Meteorology and Weather Forecasting a Unit.

In the organization of Government operations and activities with reference to meteorology and aviation, it is deemed to be a fundamental proposition that the whole problem of meteorological advices and warnings constitute a unit, for this service can only be administered when a comprehensive system of observations are available from a network of stations furnishing the fullest possible data concerning the conditions of the atmosphere, not only over the continents but over the oceans and at all altitudes accessible.

On this principle, prior to the war the Weather Bureau received, by international co-operation, reports from the entire Northern Hemisphere, and published a daily weather map of the same. This service, suspended by the war, is now only partly restored. For fifty years the Weather Bureau has been an essential unit dealing with meteorology. Segregation of essential functions and activities, or the assignment of portions of its work to other organizations, cannot be accomplished without loss of efficiency or great increase in cost and duplication and conflict of effort, because the fundamental system of complete observations and reports must be available for study and application by an agency attempting to furnish advices and forecasts.

Policy and Program

Any program of meteorological work in aid of aeronautics is necessarily very intimately associated and interlocked with general meteorological work, forecasts, warnings and advices of every character. For this service it is fundamentally essential to maintain a comprehensive network of stations over the entire continental area of the United States from which observations and reports are regularly and systematically received, including observations of the free air. Where practicable by international co-operation and otherwise, such reports must be supplemented by reports from the other continents and the oceans.

In the specific interests of aviation this system of stations must include stations for the making of observations in the free air by the use of kites, balloons and other agencies. At present only six completely equipped stations are in operation, supplemented by a small number of stations at which only pilot balloon observations are made. Reports furnish twice daily the direction and velocity of motion of the free air in different altitudes at from about 500 meters to about 3,000 or 4,000 meters above the surface of the earth. Results are telegraphed promptly to Washington twice a day and are used in furnishing daily forecasts and warnings which are sent to the aviation branches of the Army, the Navy, the Post Office Department, aeronautical clubs, and all civilian interests who can utilize and desire the advices and information.

Present appropriations. The amount of money expended for all purposes identified immediately with the exploration of the free air is at present $81,020, this being the total of the appropriation for the year 1920-21. For 1921-22 the same appropriation, $81,020, is available.

The above sum is supplemental to the general appropriations of the Weather Bureau for all purposes, and the general resources of the Weather Bureau are of course available to supplement the actual sum appropriated for aviation purposes.

(*To be continued*)

FOREIGN TECHNICAL DIGEST

The Rigid Airship

The articles appear to be the first two of a series giving a detailed account of German rigid airships of Zeppelin and S.L. types.

In the present articles tables are given showing the place of construction, capacity, number of gasbags, length, diameter, useful load, number of motors and h.p., and speed of 116 ships of the Zeppelin type (No. 113 corresponds to L.71), and 22 of the S. L. type. Remarks concerning the destruction or loss of each ship are given. (F. Stahl, *Illustrierte Flug-Welt*, Nov. 24 and Dec. 8, 1920. 6½ pp.)

The Zodiac Sport-Airship

A description of a small, non-rigid airship for carrying two persons is given.

The capacity is 1,000 cu. metres with a radius of action of 300 km. With a 60 h.p. Gnome-et-Rhone Motor, Type Z9, a speed of 60 km/hr. has been obtained. The car is fitted with appliances at its after end for mast mooring. It is suggested that the ship is specially suited for sport or for training pilots.

Three diagrams show the general arrangement of the airship. (*Illustrierte Flug-Welt*, Nov. 24. 1920. 1½ pp., 3 figs.)

Fairey Flying Boat

The new Fairey flying boat now at Grays being re-erected after building at Hayes (Middlesex) will be launched in May. This is one of three machines, and represents a type larger, stronger, and more capable and seaworthy than any seagoing aircraft yet built. One of the remaining two is being constructed at Preston by the English Electric Company.

The span of the wings of the new Fairey flying boat is 140 ft., and the overall length 67 ft. She is being fitted with four Rolls-Royce engines, each of 600 h.p. The hull was designed by the late Colonel Linton Hope. It has been rendered flexible and shock absorbing by a special process of construction, and is made without bulkheads. The wings are of the patent Fairey variable camber type, giving high lift. The total weight of the flying boat is 15 tons.

The work for which this giant aircraft has been designed and built is long distance sea patrol. She has a range of 1,500 miles and will be capable of remaining at sea for some days at a stretch. She will operate from a sea base much in the same way as a submarine returning to port for stores and fuel. The Fairey flying boat will be able to dispense with anything in the nature of a parent ship. She will carry a crew of seven, and has emplacements for five machine guns, of which a proportion are fitted in the wings. Her cruising speed will be 110 m.p.h. (The *Times*, Mar. 4, 1921.)

The Sablatnig Sporting Monoplane

Three views of this small single-seater machine are given. It has a span of 8.4 meters, a height of 2.2 meters, and a length of 5.3 meters. The engine is a 20-hp. six-cylinder air-cooled radial, giving a speed of 110 kilometers per hour. (*Illustrierte Flug-Welt*, Dec. 22, 1920, 4 cols., 2 figs.)

The De H-14 Day Bomber

This machine was designed during the latter part of 1918. It is fitted with the new Rolls-Royce "Condor" engine of 600 h.p., and is thus the highest-powered single engine fitted machine in existence.

The engine is mounted on tubular bearers, which are supported on multi-ply wood bulkheads. The nose radiator is provided with slats by which the pilot can control the amount of cooling from the maximum radiator capacity to entire blanketing.

The petrol system has three alternatives, feeding to the carburetor either from the gravity tank, or one of two independent wind-driven pumps. The new Smith's petrol gauge is fitted with the dial on the pilot's dashboard.

The seating is of conventional two-seater design. The pilot is provided with one Vickers' gun, firing forward, and the gunner with the usual Scarff ring. Six 112-lb. bombs are carried inside the fuselage in front of the pilot's cockpit, with release toggles in both cockpits.

The fuselage embodies a unique design of longeron fitting at points where heavy loads have to be taken, such as the undercarriage strut attachments. The wooden longerons are made in short lengths, and at these points rectangular aluminium blocks, with suitable projections for the attachments, are substituted for the wooden member. Other fuselage fittings are of standard De H. design.

The undercarriage, except for the abovementioned attachment, is of standard De H. practice, with wooden Vee struts and rubber cord shock absorber. The tail plane trimming gear is provided with a guard which forms an auxiliary tail skid if necessary.

Main data are as follows:

	lbs.
Weight, empty	4,484
Petrol (178 gallons)	1,280
Oil	160
Crew	360
Military load	1,380
Total weight fully loaded	7,664

Speed at 10,000 ft. . . . . .122 m.p.h.
Rate of climb at 10,000 ft. . . . . .400 ft./min.

(*Flight*, Jan. 13, 1921.)

The Albatros W-10 Flying Boat

The flying boat is developed from a somewhat similar design prepared before the Armistice and equipped with an engine of smaller power than originally proposed. It has apparently passed the censorship of the Inter-Allied Commission of Control as a civil aircraft.

In general outline the machine strongly resembles the Dornier type, but, unlike the Dornier boats, it is not an all-metal affair.

The hull is of three-ply, as are the side balancing extensions thereto. The pilot is accommodated in the nose of the hull; two side-by-side seats for passengers follow, with an emergency seat for a third behind. Ailerons, elevators and rudder are all balanced, and are built on duralumin skeletons. (*Aeroplane*, March 30, 1921.)

The Zeppelin-Staaken All-Metal Monoplanes

We have already published several photographs of the Zeppelin-Staaken monoplane, and a brief description of the machine, which is built of metal throughout, even to the wing covering, the metal chiefly used being aluminium alloy. On its test flight this machine is said to have given very good results so much so that it rather surprised its designer, Herr A. K. Rohrbach. We understand that a cruising speed of about 120 m.p.h. is attained, and that the full speed is somewhere in the neighborhood of 135 m.p.h. The wing area is approximately 1,150 sq ft., and the weight fully loaded about 18,650 lbs. This gives a wing loading of 16.2 lbs./sq. ft., which is extraordinarily high even considering that the wing is of high-lift section. We have no figures of the landing speed, but it must be rather high for a commercial machine. The power loading is about 18 lbs./h.p., so that if the figures given for maximum speed are correct, the machine appears to be extraordinarily efficient as regards resistance. So much so that one very much doubts whether such a speed has ever been attained by the machine, except in a steep dive. It is true that the heavy wing loading would tend to increase the average figure, which is based on a wing loading of 7 lbs./sq. ft., but even so it is doubtful whether the speed is possible for that power loading.

Our correspondent does not inform us of any tests having been made with cutting-out one of the outer engines, but the fact that the distance from these to the center line is so great would almost certainly result in a turning moment of such magnitude that the corresponding engine on the other side would have to be cut out, or at any rate throttled down. Thus in practice the cutting-out of one engine would really mean the loss of practically half the power.

The results attained with this first machine have been so promising that a second one, of slightly different type, is now being constructed. This machine, of which no photographs are available yet, will have two engines only. This arrangement should be much better, as the two engines, by being pushed far forward and kept as close together as the airscrews will permit, are not far from the center line of the machine. The object of placing the engines so far forward is evidently to help bring the nose of the *fuselage* back so as to avoid the gap between the two propellers that would otherwise be necessary if the body projected forward between them. What the effect on the front-wing spars will be is another matter. One would imagine that the down load in a dive, aggravated by the projecting engines, might prove somewhat heavy for the front-wing spars, especially as there is no top-bracing. However, the wing is so deep in section that possibly the spar is capable of taking the stresses and allow of a reasonable factor of safety. Otherwise we think that the new monoplane is a great improvement on the older type. The cabin is low over the ground, and the door, when the tail is down, may be entered without the use of steps. (*Flight*, March 17, 1921.)

NAVAL and MILITARY AERONAUTICS

Atlantic Fleet to See Iowa Bombed from Air

Norfolk, Va.—The doughty old battleship Iowa—famous in the Spanish-American war—will leave Norfolk on what probably will be her last voyage. The sea veteran is to be the target for a squadron of bombing aeroplanes.

The Iowa is to steam at full speed under radio control while she is being attacked from the air. There will be no one on board. The radio control will be on the battleship Ohio, which will accompany the Iowa to a point off the Virginia Capes, where the air squadron will make the attack.

The Iowa is to be sacrificed in the presence of practically all the ships of the Atlantic fleet, which will arrive in Hampton Roads from Cuba next week.

Five of the most powerful bombing machines in the navy will be used in the attack on the Iowa. They are now being made ready at the naval operating base. Bombs are to be dropped from the heights ranging from 500 to 3,000 feet. Vital parts of the ship are to be chalked off and aviators will endeavor to drop bombs on these parts.

Wireless to Make Navigation of Air Safer in Future

Ad. W. H. Bullard, director of naval communication service, in a recent address, said wireless telegraphy is making navigation simple and safe.

"There will be a time when ships will be without chronometers and will be in constant wireless touch with New York until they reach the British channel," said Admiral Bullard. "This is not a dream; it is near at hand.

"By means of the radio compass a ship can get her bearings when she calls for it, anywhere along the coast of the United States. This instrument has already saved ships which were headed straight for the shore.

The depth of water under the ship can now be accurately determined by the reflection from the ocean bottom of the sound of the ship's propeller. By this device shallow water can be avoided and even the proximity of icebergs detected. Ships can also communicate with each other by underwater waves, sent out by oscillators.

"By means of a cable laid along the bottom of New York channel and energized with current, a pilot, blindfolded, guided a destroyer safely to port, never getting more than 50 yards from the cable. The waves sent out by the cable were detected in telephoning him whether he was to right or left of the guiding cable.

"Hurricanes can be detected by sensitive radio telephones, and even the general direction of storms are felt on wireless receiving apparatus. The time is now sent broadcast by coastal stations, and by the time given for certain longitudes the ship can tell its location. Weather warnings and locations of wrecks, derelicts and icebergs are given out."

Cuba Sends Officers to United States

The Cuban government has accepted the invitation of the U. S. Government to send officers to Army schools. One officer is to attend the Air Service Observation School at Fort Sill, Okla., and another officer is to attend the Air Service Pilot School at Arcadia, Fla.

Air Service Association Is Fast Growing

The Army and Navy Air Service Association, which was formed at headquarters after the armistice, is making a very healthy growth in membership and also beginning to expand into branch associations which are forming at fields and air stations throughout the United States. In response to a letter urging those eligible to join the association writtten by Major Gen. Charles T. Menoher, U. S. A., Chief of Air Service, and president of the association there has been a large accession to membership list, twenty-eight fields and stations of the air service reporting 100 per cent. membership. Capt. William A. Moffet, director of Naval Aviation, has been invited to membership on the board of control of the association and has accepted.

Field Day at Carlstrom

A day of entertainment was put over by the Carlstrom Field personnel on Friday, April 1st. The events of the day consisted of a track and Field Meet and a baseball game. The affair was under the supervision of the newly organized Non-Commissioned Officers' Club; and too much credit cannot be given the members of the committees which put the event over. Among the guests of honor at the Field Meet were: Major Ralph Royce, Commandant of Carlstrom, and his staff.

The meet was won by Flight "B" with Flight "A" second. Probably the most spectacular showing made by any one entrant was that of Private H. R. Williams of Flight "A," who won the high jump and the 440-yard dash in easy style. The officials for the meet were as follows: Starter, Captain Hough; timer, Lieut. Dunlap; Judge, Lieut. Chauncey. Fifteen hundred visitors attended the meet.

In the evening a ball was held in Hangar "X" under the auspices of the Non-Commissioned Officers' Club. This is conceded to be the biggest affair of its kind yet held at the Field. Green moss, palmetto, green and yellow ribbons and an abundance of beautiful lights made the hangar a pleasant sight to the most discriminating eye. Music was furnished by the Hartzels Novelty Five of Cincinnati. A similar affair will be held at the Field on May 6th.

The Aberdeen Record

To date more than twice the weight of bombs dropped by the entire American Expeditionary Forces have been dropped at this station. It is believed that Aberdeen Proving Ground has the smallest active flying field in the Air Service, yet on three days — April 4th, 5th and 6th — 25,855 pounds of bombs were dropped by the operating personnel of Flight "B," 14th Squadron, which consists of 6 officers and 63 enlisted men. Flight "B" therefore believes that it is warranted in challenging any and all Air Service stations to a duplication of this record.

Bombing Thrills

That bombing is not without an occasional thrill was demonstrated a few days ago when a missing motor on the take-off necessitated dropping two 300-pound bombs on the edge of the flying field from an altitude of less than 50 feet. The bombs bounced along the ground on their sides and when examined later it was found that one safety had failed with the result that a fulminate detonator had been slightly dented, just slightly enough, in fact, to avoid a detonation and consequent serious results.

Changes of Station of Officers For Week Ending April 12

April 7, 1921—Orders previously issued sending Lieutenant John S. Crawford, Air Service, from Brooks Field, Texas, to Ross Field, California, revoked.

April 7, 1921—First Lieutenant George H. Brown, Air Service, relieved from further duty at Bolling Field, Aanacostia, D. C., and ordered to Chanute Field, Rantoul, Illinois, for course at Air Service Mechanics School.

April 7, 1921—Lieutenant William G. Moore ordered from Barron Field, Everman, Texas, to Miller Field, Long Island, New York, for duty.

April 7, 1921—Major Walter R. Weaver ordered from Kelley Field, San Antonio, Texas, to Washington, D. C., for duty in office, Chief of Air Service.

April 7, 1921—First Lieutenant James P. Jacobs, Air Service, relieved from duty with Air Service at March Field and returned to Coast Artillery.

April 8, 1921—First Lieutenant Arthur H. Beese relieved from duty with Air Service at March Field and returned to duty with Cavalry.

April 8, 1921—Lieutenant Lawrence P. Hickey, Air Service, ordered from March Field, Riverside, California, to Kelley Field, San Antonio, Texas, for pursuit training.

April 8, 1921—Major Blackburn Hall, Air Service, ordered from March Field, Riverside, California, to Kelley Field for bombing training.

April 9, 1921—Following Air Service officers relieved from duty at March Field, Riverside, California, and ordered to Post Field, Ft. Sill, Oklahoma, for course at Observation School: Captain William H. Crum, 1st Lieut. Erle G. Harper, 1st. Lieut. Francis M. Brady, 1st Lieut. John W. Kelly, 1st Lieut. Ray L. Owens, Captain Charles B. B. Bubb, Captain Henry T. Morrison.

Aviation Risks Declined

New York—The association of casualty insurance companies writing health and accident insurance, known as the Bureau of Personal Accident and Health, has adopted the following provision relative to the participation by the assured in aeronautics:

"Nor shall it cover any injury, fatal or unfatal, sustained by the insured in or on any vehicle or mechanical device for aerial navigation, or in falling therefrom or therewith, or while operating or handling any such vehicle or device."

FOREIGN NEWS

Inter-Allied Commission and Germany

The following paragraph appeared in the *Press* on March 29th:—

Berlin, March 28th.—Replying to a note from the Inter-Allied Aeronautical Control Commission of March 17th asking whether manufacturers of aeronautical material are still supported by the German Government in their continued violation of the Entente's Boulogne decisions, the German Government states that it still adheres to its standpoint that the Versailles Treaty does not give the Allies the right to prolong the embargo on the manufacture and importation of aeronautical material beyond July 10th, 1920, and proposes that the matter be referred to arbitration.

Dutch Commercial Propaganda in Spain

The Netherlands Chamber of Commerce has announced that a "Dutch Week" is to be held in Madrid in May, for the purpose of fostering good relations between Holland and Spain. It is said that the Netherlands Government will send a squadron of military Fokker aeroplanes to assist in the demonstrations. It is also stated that the Netherlands Aircraft Company may send several Fokker Commercial aeroplanes in order to arouse interest in air transport with the Spanish authorities, especially the postal department. The machines are of the type now carrying mails between Holland and England, Germany and Denmark.

German Air Traffic With Lithuania and Poland

The German Air Transport companies are making good use of the sad state of railroad and other transportation systems in the countries of their new Eastern neighbors.

A German company recently opened a regular service with Fokker passenger and freight planes between Danzig, Kovno and Vilna and between Danzig and Warsaw. The first two of these Dutch planes arrived by air from the Fokker factory recently, one stop being made en route, at Warnemunde; each machine carries 1200 lbs. of freight so the service should prove a useful connection for passengers and urgent supplies between the centres of Lithuania and Poland and the Baltic ports.

The Oehmichen Helicopter

The Oehmichen helicopter has made its first horizontal flight. Still fitted with the gas bag which guaranttes the pilot against accidents during the trial flights, it flew 75 yards against the wind. This makes the 76th flight accomplished by the Oehmichen helicopter.

London Aerial Derby

It has been decided to hold the Aerial Derby on Saturdays, July 16, 1921, at the Hendon Aerodrome. The arrangements between the Royal Aero Club and the Grahame-White Company for the use of Hendon Aerodrome for aviation races have been approved.

International Exhibition of Aero Engine

It is announced from Paris that the Aeronautical Constructors' Association has definitely decided to hold at the Grand Palais in Paris, during November next, an International Exhibition of Aerial Locomotives.

New German Air Companies

"The International Air Transport Co." has been formed at Danzig with a capital of 2 million marks, subscribed by German and Polish interests. Aeroplanes are to be manufactured at the Danzig yard for its own service: Danzig-Posen-Krakau and Danzig-Warschau-Lemberg. The founders of the company are Lilienthal and Dr. Engineer Donski.

"The Lloyd Eastflight Co., Ltd.," has been formed at Berlin with a stock capital of 4 million marks, for the exploiting of flights to Danzig, for which Junkers all-metal limousines are employed. Participating founders are the Albatros Aircraft Works, at Johannisthal, Junkers at Dessau, the Lloyd Air Service at Bremen, and the East German Agriculture works at Seerappen, a former military air establishment.

The combine, grouping round the North German Lloyd shipping company and the Sablatnig aircraft works, of which the above formation is another offshoot, has also witnessed another transformation by the creation of the Lloyd-Airtraffic-Sablatnig Co., Ltd., in which the two companies named each hold 1¼ million of the 2½ million mark capital. The assets of the Sablatnig company comprise its present fleet, viz: the one folding parasol limousine monoplane, 7 four-seater former night-bomber biplanes, 8 converted war aeroplanes, 2 dispatch machines, 8 seaplanes, 7 220 h.p. Benz engines, and the air stations at Berlin, Johannisthal, Warnemünde, Bremen, Aabenraa and Copenhagen. The latter two belong to the affiliated Danish company, Danish Air Express Co., Ltd., which has not been able to obtain concessions so far from the Danish Government, as the greater part of the 350,000 crowns capital is German money.

An Italian Aeronautical Mission to Ecuador

An Italian Aeronautical Mission is visiting Ecuador with the object of introducing into the market Italian Aircraft. From reports received, it is stated that a contract has been secured for the establishment, by an Italian concern, of the only available ground near the capital, and the eventual construction of a Flying School for both military and civil purposes.

Lieuts. Ellice and Guicciardi, on two Salmson biplanes, gave a flying display before the Minister of War. A cross country flight was made from Quinto to Ciencia, a distance of 250 miles, in 1 hr. 40 min., at an altitude of 6,500 metres.

This mission, it is reported, has been very successful in securing contracts for the various Italian firms it represents, and an agency has been opened by them, known as the Ca. Ecuatoriana de Aviacon y Transportes.

A Danish Mission to England

The Department of Overseas Trade announces that an Advisory Committee has been appointed by the Danish Government to draw up plans for the erection of an air station at Kastrup in the Island of Amager, near Copenhagen. The station is to include an aerodrome base, and a seaplane harbour. The following are the members of the Committee: Mr. Knud Gregersen, of the Ministry of Traffic; Mr. Sven Svendsen, a Member of the Rigsdag; Lieut.-Col. Kock, commanding the Danish Military Flying Corps; Commander Grandjean, commanding the Danish Naval Flying Corps; Messrs. Helwig and Jensen, two Government engineers.

The Committee will visit England and France in the course of the next few weeks in order to study aerodrome organization in the two countries.

At the conclusion of their labours and the presentation of the necessary report to the Government it is thought that it will be possible to begin the construction of the aerodrome and seaplane harbour in the spring of 1922 and the airship base in 1925.

Handley-Page in the Argentine

According to an authority in the Argentine the Handley Page Co. there have sold eight "disposal" Avros, and have also presented one Avro and one Bristol "Fighter" (300 h.p. Hispano-Suiza) to the Argentine Army. In addition they have sold some eight or ten machines, all of them with the exception of two Avros, being Bristol "Fighters."

It is understood that a part of the conditions of sale of the eight Avros to the Army was that they should instruct a certain number of pupils. This is being done by their pilot, Mr. Clowes, and in addition he is also instructing two private individuals on Avros.

The only long flight they have carried out was one from Buenos Aires to Santa Rosa de Toay, a distance of about 325 miles, on a Bristol, which took about four hours.

French Disposal Company

The Société Commerciale des Stocks de l'Aviation formed recently to dispose of surplus aircraft material accumulated in consequence of war contracts has now begun work in seven separate camps. These are Mortemets, near Versailles, Blanc-Mesnil, Esquenoy (Oise), Marigny-le-Chatel (Aube), Equennes (Somme), and Voves (Eure et Loire).

Proposed New Mail Service to Antipodes

A request that a mail service from Great Britain to New Zealand by way of San Francisco and Vancouver be instituted as early as possible has been made to the Postmaster-General by the New Zealand and Australian Agents' Association.

Civil Aviation in the House of Commons

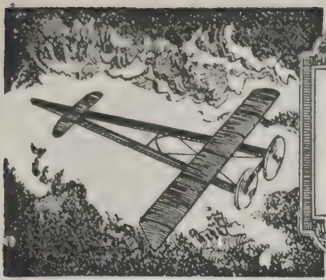
During the discussion of the Consolidated Fund Bill on March 22, Sir W. Joynson-Hicks again raised the subject of civil aviation, with particular reference to the scrapping of the airship service. He wanted to know if it would not be possible to set aside, out of the Air Estimates, a sum of from £150,000 to £200,000 for civil aviation during the current year. Regarding the airships, he pleaded that the expenditure of a quarter of a million a year for the next two years would enable the experts to decide conclusively whether or not the airships are going to be useful for military or naval purposes. He pointed out that the Air Ministry proposes to expend no less than £3,250,000 on buildings this year, and asked that the Estimates should be so re-arranged that one-thirteenth of this sum could be allotted to further experimental work with the airships.

Gen. Seely followed with a trenchant criticism of the vacillations of the Government in connection with this particular side of aviation. A year ago, he said, we were told that no one could foresee the value of airships for peace. One thing was certain—that an airship had flown to America, and this one of obsolete type. A vast possibility was there for research at a very modest expenditure. And yet, within a year, we find all the expenditure on the military side going on and civil aviation absolutely at an end and the airships scattered. The British Government had never done a more absurd thing. We banked on one thing in 1919, reasserted it in 1920, and scrapped the whole lot in 1921. That was the way that minor and unimportant States acted, but it was not the way the British Empirt had been built up. It was a ridiculous thing to scrap all the intelligence, all the brains, all the effort that had been put into a three years' intensive struggle in order to save money here, while in all probability more would have to be spent in building up the airship service in years to come.

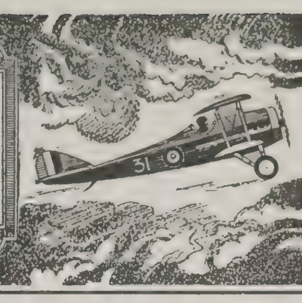
It must be said that Capt. Guest, who replied in the absence of the Air Minister, did not cut a very heroic figure. He based his defence upon the statement that a round £1,000,000 was to be devoted to civil aviation under the current Estimates. That appears to be the sole argument he was able to find in the course of a fairly lengthy speech in defence of the policy of the Air Ministry. It is a matter of common knowledge that such a sum has been allocated to civil aviation. We ourselves have commented upon the fact on more than one occasion. The real trouble is not so much with the sum estimated for as with its allocation.

We cannot, *pace* Capt. Guest, agree that everything is satisfactory when we regard the manner in which this sum is distributed. The basic fact remains that out of a million sttrling no more than £60,000 has been specifically allotted to the direct assistance of civil aviation. True, we hear that this is to be increased materially—it has been said that the sum to be thus expended is £250,000—but the point is that the present actual allotment stands at the smaller figure. It does not help much to know that a million of money is to be spent on paying an expensive staff at the Air Ministry and in laying out ground organization which is useless because there are at present no machines in the air to make use of the landing facilities on which good money is being spent—unless the deliberate intent is to encourage the foreigner to run air lines from the Continent to this country.

We agree the necessity for economy in all public expenditure, but if a million is all the country can justifiably be asked to find at the present juncture, surely it would be better to devote more of it to encouragement in the one direction and less to the payment of staffs to oversee what does not exist. Capt. Guest was at a distinct disadvantage in replying to a question which concerned another Department than his own, but with all that he was singularly unconvincing in his defence of air policy.—[*Flight.*]



ELEMENTARY AERONAUTICS *and* MODEL NOTES



CLUBS

PACIFIC MODEL AERO CLUB
240 11th Avenue, San Francisco, Cal.
Portland Chapter: c/o J. Clark,
Hotel Nortonia, Portland, Ore.

INDIANA UNIV. AERO SCIENCE CLUB
Bloomington, Indiana

BROADWAY MODEL AERO CLUB
931 North Broadway, Baltimore, Md.

PASADENA ELEM. AERONAUTICS CLUB
Pasadena High School, Pasadena, Cal.

NEBRASKA MODEL AERO CLUB
Lincoln, Nebraska

BUFFALO AERO SCIENCE CLUB
c/o C. Weyand, 48 Dodge St., Buffalo, N. Y.

ILLINOIS MODEL AERO CLUB
Room 130, Auditorium Hotel, Chicago, Ill.

SCOUT MODEL AERO CLUB
304 Chamber of Commerce Bldg.,
Indianapolis, Indiana

MILWAUKEE MODEL AERO CLUB
455 Murray Ave., Milwaukee, Wis.

MODEL AERO CLUB OF OXFORD
Oxford, Pa.

CAPITOL MODEL AERO CLUB
1726 M St., N. W., Washington, D. C.

AERO SCIENCE CLUB OF AMERICA
Beach Bldg., E. 23rd St., New York City

AERO CLUB OF LANE TECH. H. S.
Sedgwick & Division Sts., Chicago, Ill.

LITTLE ROCK MODEL AERO CLUB
1813 W. 7th St., Little Rock, Ark.

Models Built by Aerial Age Readers

A 6-foot model of the Curtiss JN4D-2 is being completed by James Mitchell of Detroit, Mich. Mr. Mitchell, who is only 16 years of age and a student at Cass Technical High School, is building this model to be equipped with an engine designed by his father. The engine design is for a V type with 8 cylinders, and a working model of it has already been built. Theoretical calculations indicate that the engine, which is run by compressed air, will produce a little more than 2 H. P. although weighing 9¾ pounds. The first engine built was cast in brass but preparations are now made to use an aluminum casting which would bring the weight down to about 3½ pounds. The specifications of the model are as follows:

Span	6′ 6″
Length	3′ 10″
Wing Area	9.5 sq. ft.
Gap	9½″
Chord	8½″
Propeller	3½′ pitch, 20″ diameter
Weight	3.75 pounds
Engine, 8 cyl. compressed air	2 H. P.

Other models built by Mr. Mitchell include a 3-foot Curtiss, 26″ S.E.5, 3-foot Curtiss Tractor, 3-foot Nieuport, and several others. He has been building models for three years and for the past year and a half has used to advantage many of the features on construction published in Aerial Age.

A scale model of the Ansaldo-1, built by Mr. B. Pond, has been a consistent flier and prize-winner in Illinois Model Aero Club contests. This model, built from drawings which appeared in a 1919 issue of Aerial Age, paid good returns for the careful workmanship put into it by winning first place and a shield in a contest of December, 1919, second place a year later and another second place in January, 1921. Its best flight was one of 21 seconds' duration; it also made a flight of 15.4 seconds in a contest for gear-driven models.

The model is constructed principally of bamboo. The wing beams, motor base and propeller are of white pine. The power plant is removable as a unit, permitting the rubber to be wound with an egg beater, a splendid improvement first introduced into the Illinois Model Aero Club on this particular model. The covering is of silk tissue paper doped with acetone. The incidence angles and the position of upper and lower wings are adjustable within small limits to permit balancing properly under different conditions of flight. The model has a wing span of 28″ and weighs complete, ready to fly, 1.94 ounces.

Mr. Pond is the builder of a hand-launched distance model which broke all records last August in contests held by the Illinois Model Aero Club.

The Composition of Aluminum Alloys

Engineers skilled in the art of combining aluminum with other metals are constantly experimenting with combinations and proportions of hardening metals, to make it more suitable for practical industrial uses.

The particular property which enhances the use of aluminum is its low specific gravity, but for many actual applications the pure metal is of unsufficient strength. In alloying it with other metals to attain the required tenacity, the sacrifice of low gravity is involved. When combined with "magnesium" the alloy is not lowered in specific gravity, but the resulting alloy is of a corrodible nature. The comparatively high cost of alloys restricts their use to conditions where lightness in weight is very important. In connection with the use of aluminum pistons in internal combustion engines, investigations made to determine which alloys show the most favorable tenacity at rather high temperatures, revealed that a very good alloy for the purpose is that containing 14% of copper and 1% manganese. A remarkable feature of this alloy is that it increased in tenacity as its temperature is increased up to 250° centigrade. For all temperatures up to 310° an alloy composed of 4% copper, 2% nickel and 1½% managanese showed the highest tenacity of all the alloys tested. It is expected that the adoption of such an alloy will eliminate the difficulties experienced from burnt pistons.

The employment of aluminum alloy pistons has brought about a power increase of about 20% over the results obtained by comparison with engines using iron or steel pistons. In the case of aluminum castings for cylinders of air-cooled engines, a marked advance has been shown in the freedom from distortion usually associated with the high conductivity of aluminum. Aluminum cylinder heads and aluminum alloy connecting rods can be employed to advantage.

The construction of girders for rigid airship frame-work also offers a wide field for aluminum alloys and it is considered that they will have an important bearing on the development of the all-metal aeroplane. These phases of the science are dealt with in detail in a series of lectures by W. Rosenhain, D.Sc., F.R.S., quoted in the Journal of the Royal Society of Arts.

Model Builder Wants Speed Race

Builders of model aeroplanes are invited by Dominic d'Eustachio, of Perth Amboy, N. J., to compete with him in contests for speed and distance any Saturday or Sunday afternoon. Mr. d'Eustachio requests, however, that the contests be held not more than thirty miles from his residence (Perth Amboy is about twenty miles from New York City). The model which will be matched against contestants is of the hand-launched type, having a length of 36 inches and a wing span of 30 inches. Twin pusher propellers 9½ inches in diameter and with a 19-inch pitch are employed.

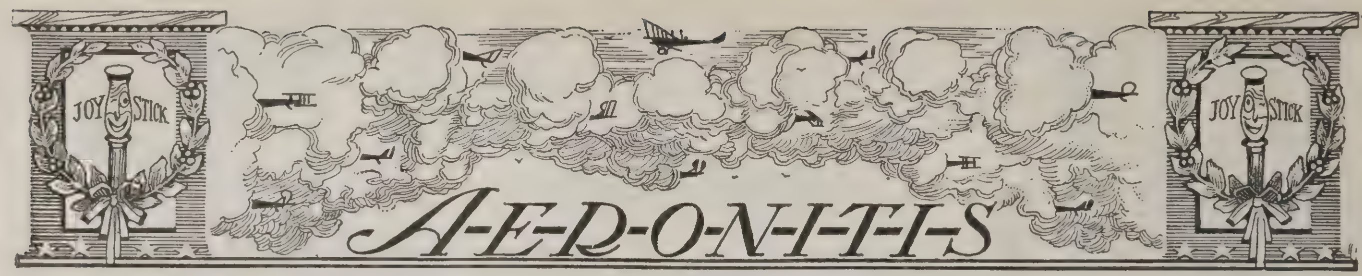
Mr. d'Eustachio is also desirous of joining a model aeroplane club in that section of New Jersey and wishes club secretaries to correspond with him at 175 Water Street.

New Model Club in Pennsylvania

Charles W. Bean, of Pottstown, Pa., is anxious to organize a model aeroplane club in his town and will welcome communications from young men in that region who wish to become affiliated with such an organization. Letters should be addressed to Mr. Bean at 329 Cherry Street, Pottstown, Pa.

The Use of "U" Section Steel for Models

The steel "U" section of an umbrella rib makes an ideal material for use in model aeroplane work. When used for the trailing edge of large model wings (having a chord of six to eight inches) the material is easily attached and can hardly be surpassed for appearance. As it is difficult to make bends in the "U" section, wing tips can be made of steel wire or rattan which adapts itself very nicely to the inside of the "U" section when the two materials are joined. Steel umbrella ribs are often used in frame-work in bracing members with good effect. The chassis members and even the main wing spars of compressed air driven models are neatly made with the steel "U" section, which is generally very springy and apt to retain its shape indefinitely.



In My Plane

Out on the endless roads of the sky
In my aeroplane I'll climb and fly,
All through the realms of the stars I'll race
On the wings of wind through boundless space.

I'll fathom the farthest bounds of the air
And find what treasures are hidden there—
Freedom unfettered, and limitless span—
The dearest dreams of the race of man.

A. L. Fowler.

Way Up Here in This Big Air Ship!

What a wonderful trip, in a big airship—
Up, up,—and up into the sky,—
My heart doth fill, with a mystic thrill,
As I fly, and fly,—fly on, and fly!
The sun shines bright, on this airy flight,
As we dip and roll, in our headlong gait,—
The world below, doth smaller grow,
As we plow the air, with this human freight.

One's free from care, high up in air—
The pilot's eyes are keen;
We skim along, with care-free song,—
With the Blue above, the World below,—and we between!

The river's turn,—wild cataracts churn;
The forests march to the snow-line throng,—
Then, deep ravine,—silvery thread between,
Winding off to the ocean, far along.

And oh, the sight, of oncoming night—
As shadows fall oe'r the earth below,—
The towns light up, as we prepare to sup—
A million lights, like fire-flies glow;
And slight careens, upset not, our dreams
As we skim o'er the slumbering world below;
Oh, it's a wondrous trip, and a joyous trip—
Way up here in this big airship!

(Copyright, 1921, by Charles L. Pryal.)

EQUATION

She: Would you call this doing the figure eight higher mathematics?

He: Yep. Plane geometry.

An Airman's Dream of Rest

When the war is over and we've done the Belgians proud,
I'm going to keep a chrysalis and read to it aloud;
When the war is over and we've finished up the show,
I'm going to plant a lemon-pip and listen to it grow.

When the war is over and the battle has been won,
I'm going to buy a barnacle and take it for a run;
When the war is over and the German fleet we sink,
I'm going to keep a silk-worm's egg and listen to it think.

When the war is over and the Kaiser's out of print,
I'm going to buy some tortoises and watch the beggars sprint;
When the war is over and the sword at last we sheathe,
I'm going to buy a jelly-fish and listen to it breathe.

Observer.

Our Own Specifications

(*Editor's Note.*—We found this article on the desk of one of our proofreaders. He had just finished tabulating the specifications and requirements for dirigibles of eighteen countries, and we fear that his mind was affected from wading through six hundred pages of technical data.)

1. All bids must be in the day before they are due or the bidder may have to pay some penalty for being late.

2. Kindly send on no drawings ahead of time because we are liable to get them mixed up.

3. After bids are awarded to the winning firm, eight of our inspectors, who know absolutely nothing about balloons, will be sent to each factory to see that no materials not up to our standards are used. These inspectors will have the final say in all disputes. If the contractor objects to their decision he can write to us, but absolutely no attention will be paid to the letter.

4. After the dirigibles are constructed we *may* buy them, but we guarantee nothing.

5. Nothing in paragraph 4 is to be construed as a contract.

6. If the finished machine weighs more than we think it should, we retain the option of, 1, refusing to accept the machine; 2, taking it but not paying for it. (In most cases the latter method will be followed.)

7. Nothing in paragraph 6 is to be construed as a contract.

8. For every day in advance of the stipulated time that the machine is completed the contractor will have our heartfelt thanks, but we will exact a penalty of one hundred dollars a day for each day beyond the specified time.

9. The successful bidder must agree to split fifty-fifty with the inspectors.

10. However, we reserve the right to change our mind at any time and stop work on the machines, in which instance the contractor will be thanked for his pains.

11. Nothing in any of the above paragraphs is to be construed as a contract.

AERIAL AGE
WEEKLY

.. 13, No. 9 | MAY 9, 1921 | 10 CENTS A COPY

Airscape of Luna Park, Coney Island. Photographed by the Army Air Service

Spirited Rivalry Between Army and Navy Air Service as Bombing Tests Near

LHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
tions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

NINE MILES PER GALLON

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIII NEW YORK, MAY 9, 1921 NO. 9

SPIRITED RIVALRY BETWEEN ARMY AND NAVY AIR SERVICES AS BOMBING TESTS NEAR

THE army and navy are literally on the "qui vive" as the day approaches for the tests of the relative merit of the aeroplane and the battleship. From the highest official in either service to the newest recruit interest centres in the question as to which is superior—the bird of the air or the whale of the ocean.

The tension is developing a serious aspect. Unsupported charges and counter charges of plots and sharp practices are being bandied about. Officers and men and civilian officials of both services seem to be at dagger's point, and it would not be surprising if the verbal barrage being laid down by both sides should bring Congressional intervention.

The latest allegation, promptly denied by both Secretary of War Weeks and Acting Secretary of the Navy Roosevelt, is that the navy has demanded and received a written apology from the army for the "impudence" of army flyers in dropping dummy bombs, inscribed, "Regards to the Navy," on the old battleship Indiana in Hampton Roads.

It is contended this was insult added to injury, because the army flyers on that day scored eleven hits out of twelve tries. According to the report, Captain Moffett, in charge of the navy air force, protested to Secretary of the Navy Denby, who in turn protested to Secretary Weeks, who answered with a written apology. All of these denied that an apology had been asked for or received, or that even a protest had been lodged.

The report that an attempt is being made to sidetrack the Army Air Service in the proposed tests brought a sharp statement from General Menoher that no such attempt would be successful and that the army would be on the job. General Menoher pointed out that orders were issued for the mobilization at Hampton Roads of the army officers and men who would participate and that practice would be continued.

The Aeroplane and Therapeutics

MEDICAL science has discovered a new therapeutic agent in the aeroplane. The curative value of aeroplane and balloon flights in the rarefied air regions was brought forcibly to the attention of the medical world by a recent incident in Washington. H. A. Renz, Jr., who was rendered voiceless during the world war, was advised by Dr. Charles A. McEnerney of the Public Health Service to make an aeroplane flight. Renz was taken up by a government aeroplane at Bolling Field and reaching an altitude of 14,000 feet was brought back to the field.

Renz recovered his voice and made the announcement to his mother over the field telephone.

The air service pointed out that Miss Grace Ford, a Roanoke, Va., girl, recovered her singing voice in a similar manner. Miss Ford was one of the first to volunteer for service as an entertainer for the soldiers. Early in 1918 her voice failed her. Every effort to find a remedy failed until in the fall of 1918, when she made an aeroplane trip. This was while she was in Lima, Peru. President Leguia had asked her to sing. She was preparing to send her regrets and an explanation, when a former army officer asked her to accompany him on a flight.

When they reached an altitude of 8,000 feet Miss Ford said she felt a curious sensation of the throat and nose. She said the sensation was akin to nosebleed. At 10,000 feet her throat and nose lost the peculiar sensation. She immediately thought of her voice and essayed a few notes. To her surprise, her voice was clear and audible above the roar of the propeller. Miss Ford that evening sang at the palace.

Physicians attached to the public health service believe there is a tremendous field of possibilities in the investigation of flying for curative purposes. Many well known doctors are studying the effects of rarefied air on certain diseases.

Back in 1786 the "Aeropaidia," the first handbook on aeronautics in the English language, was printed. It recommended balloon ascents for convalescents.

"The spirits are raised by the purity of the air and rest in this clearful atmosphere," and author wrote.

He advised scientific investigation of the physical and mental reaction to tastes and odors at different altitudes and suggested the possibility that the tonic effect of change from hot and impure air to cool, pure air, impregnated with invigorating aerial acid, might contribute, without the aid of drugs, to the sick and invalid.

A surgeon in the Royal Air Force, England, called attention to several cures of ailments effected by flying. These cures ranged from the cold to phthisis and influenza.

The nerve specialist may find a wide field of operation, the air service experts said.

The near future may be held likely to produce the aerial sanatorium and the aerotherapist.

THE NEWS OF THE WEEK

Secretary Denby Opposed to Unified Air Control

Washington.—Secretary of the Navy Denby told the House Committee on Naval Affairs April 25 that he is absolutely opposed to a separate air service with unified control over army, navy, other governmental aviation and civilian flying.

The view of Mr. Denby was sought while he was urging the passage of legislation creating a Bureau of Aeronautics in the Navy Department, which President Harding recently recommended.

"A Bureau of Aeronautics in the Navy Department is necessary in the interest of Aviation development," he said. "At present, aviation activities are scattered through perhaps a dozen bureaus. The plan is to bring all activities into one bureau."

The creation of such a bureau was recommended to President Harding by the National Advisory Committee for Aeronautics, which likewise urged the necessity for establishing a bureau of aeronautics in the Department of Commerce to take care of civil aviation, and went on record in opposition to separating aviation from the army or navy.

Secretary Denby urged the committee to be as liberal as possible in providing funds for the development of aviation in the navy.

"The people do not realize that our navy is lacking in one arm," he said. "Aviation has become a vital part of our naval forces. If our fleet should ever engage another force it should be just as fully equipped with planes and carriers as its opponent in order to be on an equal footing." He said a Bureau of Aeronautics would decrease expenses.

Formal Opening of Aero Club of America's New Club House

A formal opening of the Aero Club of America's new Club House at Hazelhurst Field, Garden City, L. I., will be held on Sunday, May 15, from one to five p. m.

A tentative program has been arranged which will include flying events of all descriptions.

1. The Army has agreed to furnish machines for various events. There will also be parachute drops, battle formations and demonstrations of bomb dropping upon the outlines of battleships marked on the ground, to show what the Army is planning to do in its coming demonstration upon real battleships off the Virginia Capes. They will also have the Ambulance "Eagle" to show how it is used to carry the wounded.

2. The Lawrence-Sperry Aircraft Corporation will demonstrate with a Sperry Messenger and give an exhibition of stunt flying with Avros. It is also expected that there will be some of the Army Orenco machines, which will give an exhibition of aerial acrobatics.

3. There will be Air Mail machines flying and for exhibition on the lines, and machines of the S. V. A. and Farnum companies will also be represented.

4. The Curtiss Company will have machines for exhibition and passenger carrying.

5. Laura Bromwell will attempt to break her loop record and challenge Miss Jane Herveaux to an acrobatic contest.

Invitations have been extended to officers of the Air Service in Washington to fly up for this occasion.

The Club House of the Aero Club of America has been fitted up in a very attractive manner, and it is expected to have many interesting functions and events upon this field during the coming season, including the Inter-collegiate races and Saturday and Sunday matinees races, and an opportunity will be offered to members of the Club to take flights themselves and to arrange for flights for their friends.

Capt. W. A. Moffett, Director of Naval Aviation, greeting the returning Marine flyers at Bolling Field. Left to right: Capt. Moffett, Major Turner, Lieut. Bradley, Sgt. Rucker, and Lieut. Sanderson *Official photograph U. S. Naval Aviation*

Gordon Bennett Balloon Race

The possibility that contestants in the International Gordon Bennett Balloon Race to be held at Brussels may be forced into Germany and into Russia has made it necessary to take up diplomatic questions, which may arise in order to secure the safety of the pilots and their balloons and to provide for their safe return from these countries.

National Balloon Race Entries

The Aero Club of America has received the following entries for the National Balloon Race to be held in Birmingham, Ala., on May 21:

Roy F. Donaldson will pilot the balloon "City of Birmingham," and will have Mr. W. E. Robinson of the University of Illinois as his aide.

Wade T. Van Orman will pilot the balloon "City of Akron" and will have Mr. Willard P. Seiberling as his aide. This is sponsored by the Akron Chamber of Commerce.

J. S. McKibben, of 3645 Laclede Avenue, St. Louis, Mo., will pilot the balloon "St. Louis No. 5."

H. E. Honeywell, Price Road, Clayton, Mo.

Ralph Upson, 22 East 17th Street, New York, with Mr. C. G. Andrus as his aide.

The Club has been assured that there will be three entries from the Army and one from the Navy.

The Club has taken up matters with the Air Board, Ottawa, Canada, to see that rules and regulations may be required of pilots who cross the border into Canada, so that they may return and bring their balloons back in safety. It may be that some bond may be required to insure performance.

May Destroy Surplus of Britain's Airships

London—Capt. Frederick E. Guest, the new Air Secretary, told the House of Commons April 21 that if no scheme for disposal by the Air Ministry of Great Britain's surplus airships were devisable it might be necessary to destroy them in order to save the cost of maintenance and personnel.

Aero Club of Southern California in New Quarters

The Aero Club of Southern California has moved to larger and more desirable quarters in Suite 408, Title Guarantee Building, corner of 5th and Broadway, Los Angeles.

Committee Approves Navy Air Bureau

Legislation for the creation of a bureau of aeronautics in the Navy Department, indorsed by President Harding in his message to Congress and strongly approved by aviation officials of the navy, was ordered favorably reported April 26 by the Senate Committee on Naval Affairs.

Commenting on the bill, Secretary of the Navy Denby in a letter to the committee, said:

"In view of the recommendation of President Harding, I express my appreciation for prompt action. It is of vital interest to the navy, covers all the essential points and has my hearty indorsement."

Chicago Professor Studies Pyramids from an Aeroplane

Chicago—Savants of many nations have done research work in the Orient, using the camel and the donkey as means of transportation, but no such antiquated means served the party conducted by James Henry Breasted of the University of Chicago.

They went by aeroplane and were able to find things that could not be observed from the ground. Mr. Breasted, who told his experience said they traversed nearly the whole of the 60-mile pyramid country. They circled over the most important sites and obtained photographs disclosing remains of prehistoric cemeteries too faintly defined to be observed from the ground.

These photographs are expected to be of great assistance in uncovering the ruins of this ancient world, now buried in the desert sands.

The expedition was for the purpose of obtaining a share of the rich treasures from homes of earliest civilization, first made accessible by the great war and the fall of the Ottoman empire, to be placed in a new Oriental museum at the university.

Aero Club of Ithaca Elects Officers

The Aero Club of Ithaca held its semiannual election of officers April 6 in the club's headquarters at 311 E. Buffalo St. H. E. Dowd who has been president of the organization since its inception, in a brief address tendered his resignation, stating his desire to be free to pursue more closely the scientific and experimental side of aeronautics.

Mr. Paul D. Wilson, Thomas-Morse test pilot, was elected president. Mr. Wilson stated that it was his desire to push with all possible haste the construction of the club's experimental glider. He also expressed his opinion that the club's educational programs might be conducted on somewhat of a larger scale.

The other officers and committees elected are as follows: Vice President-Treasurer, S. L. Tuttle; Secretary, J. N. Leggett; Publicity Manager, R. E. Dowd.

Membership Committee: H. M. Wardwell, Chairman; W. A. Ray, F. C. Shannon.

Contest Committee: M. S. Kwei, Chairman; A. E. Larsen, R. E. Dowd.

Model Section: A. E. Larsen, Chairman; Frank Rogers, Lyman Fisher (junior member).

Educational Committtee: R. E. Dowd, Chairman; George Norris, R. F. Hall.

The Model Section is a new department of the club that will have in charge the training and instructing of the junior members in model aviation. Work bench, tools, material and instruction will be provided by the club and contests conducted from time to time to allow the juniors to test the merits of their products.

Air Mail Chief Is Married

John A. Jordan, chief of construction of the air mail service and acting superintendent of the Pacific division, is being congratulated on his marriage to Mrs. Samuel Henry of Stockton. Not until his return from Washington did associates of Jordan know that his recent journey to the East was not taken alone.

Speed Contests in Chicago

Considerable interest is being aroused amongst sportsmen in the Pageant of Progress which is to be held at Chicago from July 30th to August 14th next. The well-known yachtsman, Mr. Sheldon Clarke, is to be in charge of the Progress of Petroleum section of the Pageant and he has recently enlisted the co-operation of Mr. F. G. Ericson, Toronto's speedboat and aeroplane expert, who is also vice-president of the International Power Boat Union. A feature of the sporting events will be a race in which aeroplanes, automobiles and power boats will compete, each in its native element.

San Francisco Notes

Walter T. Varney took a Lincoln Standard off the Marina this week in the wind and with Ray Duhem flew to Martinez to take some moving pictures.

A Lincoln Standard Cruiser has been shipped from the Nebraska Aircraft Corp. plant to Walter T. Varney and they are expecting its arrival most any day.

"Loop the Loop" Murphy has a ship on the Marina this week. It is a J-1 Standard with a Curtis OX-5, and Murphy sure gave an exhibition of loops on Sunday last when he did twelve from low altitude. Murphy announces that the Marina will be his permanent stand.

Earl Cooper is flying out of the Aieway Field on the Sloat Boulevard. He is flying the Oriole, a J-1 and a Jennie. Also Phil Prather of the Don Lee Company has his Avro out on that field.

Flying Frolic at Oklahoma City

The Central Continental Flying School at Oklahoma held their second Flying Frolic on Sunday, April 17, and it aroused considerable local enthusiasm and interest. The program consisted of formation flying, thirty mile derby, twenty mile handicap race, eight minute altitude test, a looping contest and parachute jumps. Some of the officers from March Field participated in the contests.

Dog Smuggling by Aeroplane

London—Dog smuggling by aeroplane has arrested the interest of the British House of Lords, which recently devoted part of an afternoon to a discussion of the subject. The pampered toy dog was roundly excoriated by a number of their lordships, Lord Willoughby de Broke supporting Lord Bedislowe in a demand that "such useless brutes" be excluded from the country.

It was pointed out that it is an easy task for a person to smuggle the small lap dog into the country in a muff or basket. The Ministry of Agriculture promised to renew its vigilance in the matter of preventing dog smuggling and to increase the penalties if necessary.

Flies to Regain Speech

Denver—In an attempt to regain the power of speech, Miss Edna Kemper of North Bend, Neb., made a flight in an aeroplane here April 21 and established a new altitude record for women in the intermountain region.

In the flight Miss Kemper and her pilot, C. W. Brown, reached an altitude of 6,100 feet above Denver, or 11,380 feet above sea level. The woman was in the air one hour, forty minutes of which was occupied in the climb of 6,100 feet.

The experiment was made on the suggestion of the woman's physician, Dr. E. D. Starbird of Denver. For more than a year she has suffered from part paralysis of the vocal cords and has been unable to talk above a whisper.

Similar flights have resulted favorably in the East, but the result of Miss Kemper's experiment will not be known for several days, according to Dr. Starbird.

To Operate Mexican Planes

Tampico, Mexico—The Eastern Mexican Aviation Co. has been formed in Tampico under the management of R. H. Maloney and will operate planes in and around this city and between Tampico and the City of Mexico, San Luis, Monterey, Vera Cruz, Tuxpam, Matamoras and other cities.

Bartlett Is Named Splitdorf Executive

Newark.—M. W. Bartlett was elected vice-president and general manager of the Splitdorf Electrical Co. at a meeting of the directors April 27. He will succeed R. W. Sutherland.

Bartlett is no stranger to the Splitdorf organization. He went with the company in 1911 as secretary and remained until 1919. During the war he handled all its export sales and built up a very substantial business. He resigned in 1919 to become Eastern manager of the Wire Wheel Corp. of America in charge of sales to manufacturers and dealers east of Buffalo, as well as export sales. He is popular in the Splitdorf organization and the directors are confident the company will show marked progress under his direction.

To Build $1,200 Sport Plane

Seymour, Ind.—Assembly of aircraft and the training of pilots will be started here by the Western Airline Syndicate, which has leased a three-floor building and 25 acres of ground. The company is capitalized for a quarter of a million dollars. The big production will be devoted to a light sport plane selling for $1,200.

Two-seater Seaplane used by the Dutch Navy, and built by Van Berkels, at Rotterdam. Length over all 13.75 meters; span 19 meters; height 4.30 meters; maximum speed 180 kilometers per hour. The motor used is a Rolls-Royce Eagle 330-350 H.P. The planes will be used in the Netherland Indies

The AIRCRAFT TRADE REVIEW

Jacuzzi Monoplane Flight Tested

The Jacuzzi seven-passenger monoplane recently described in AERIAL AGE, is being flight tested by arrangement with the Air Mail Service in order that they may collect data on the comparative efficiency and speed of the Jacuzzi Commercial Monoplanes and the various types they now have in service.

The first of these trials has been completed and, although the official report has not yet been made up, the results were as follows:

Jacuzzi Commercial Monoplane in flight from San Francisco to Reno and return.

Carried: Pilot, 80 gal. of gas, 4 gal. of oil, 400 lbs. useful load.

Climbed: To an altitude of 14,000 ft. in crossing the Sierra Nevada Mountains, and showed ability to climb higher.

Speed: 90 M. P. H. average over entire distance including climb, with motor throttled to 1,650 R. P. M.

Performance: Plane and motor performed perfectly throughout the trip, neither requiring any repairs or minor adjustments.

The first flight to Reno was made on April 16, and the return flight was made April 18. The air-line distance from the Marina at San Francisco to the Municipal Field at Reno is 187 miles. The Sierra Nevadas rise to an altitude of about 8,000 ft. on this run.

Besides the noteworthy economy shown by the above figures and a consideration of the power used, a particularly striking feature of the flight from a passenger-carrying standpoint was the relative comfort enjoyed by pilot and passengers in the Jacuzzi plane as compared to the ordinary open cock-pit job. The sedan-like cabin of the Jacuzzi plane made it possible for the pilot to wear nothing more than the clothes which one would wear were they to drive to Reno in a closed car.

In this first flight the plane was not loaded to capacity nor was it driven at its full speed. The above figures could doubtless be improved by a good deal should the plane be loaded to capacity and driven "all out."

Cloudster Completed

Recent preliminary trials of the Davis-Douglas "Cloudster" showed a climb of 800 ft. per minute the first five minutes. At 15,000 ft. its climb was 400 ft. per minute. The climb was accomplished in 28 minutes. Not having any oxygen apparatus the pilot did not attempt to find its extreme ceiling. However, from these figures it is safe to assume that its ceiling is 26,000 to 28,000 ft. An attempt will be made in a short time to make an altitude record.

Semi-Annual S. A. E. Meeting

Automotive engineering interest is directed this month to the State of Indiana and the Semi-Annual Meeting of the Society of Automotive Engineers at West Baden, May 24 to 28.

V. E. Clark's paper in the Aeronautic Session will discuss the economic reasons for the present unsatisfactory status of commercial aviation with suggestions of possible remedies. S. H. Philbin will emphasize the necessity of adequate Federal legislation to secure the support of the substantial business man for air transportation. G. J. Mead's paper will criticize the present practice of power-plant installation in aircraft and point the way to probable future development.

United Airways Organized

The United Airways, Inc., with main offices in Washington, D. C., have organized with the view in mind of pursuing commercial aviation in all its phases.

This company will have a number of both land and water planes in passenger service in and near Washington, and are expecting to place into service between Washington, New York, Chicago, Norfolk, Va., Cincinnati, O., Dayton, O., St. Louis and other cities of the U. S., large passenger and freight aeroplanes of a type used so successfully in similar trips between London and Paris.

Both land and water bases will be established in Washington, D. C., for the operation of the company's ships.

The organizers of The United Airways, Inc., are: President, F. L. Rohrback; Vice President, H. H. Hunt, and Secretary, R. S. O'Neal.

Mr. Rohrback, as a business executive, is possessed with a degree of knowledge of aviation matters that is so essential in the advancement of commercial aviation.

Mr. H. H. Hunt, as Aeronautical Engineer, has been connected with aviation close to 10 years, and had a part in the early pioneering of American aviation, both in design and operation.

Mr. O'Neil, recently instructor and test pilot with the U. S. Government, has in over 600 hours' flying time in 15 different types of planes.

Freight Cars Moved by Aero Motors

Bucharest.—Aeroplane motors and propellers are being tried out here as motive power for the hauling of freight cars along railroad tracks.

During trials at an aviation field a few miles from Bucharest one motor with shaft and propeller installed on a flat car pulled two empty freight cars at a speed of thirty-three miles per hour.

New Iowa Company

The Ottumwa Aircraft Works of Ottumwa, Iowa, have purchased the Mankato & Kasota Aircraft Works of Minnesota and will operate from the flying field at Ottumwa. Willard F. Bridgeman is President of the company and Fred Parker will be chief pilot.

Aircraft Insurance Data

The Executive Committee of the National Aircraft Underwriters' Association has been meeting during the past two weeks to consider aircraft problems for the season 1921. A preliminary review of the experience showed a high loss ratio for the season 1920. Ways and means were discussed of improving the experience for the coming season. There are five general ways of accomplishing this: (a) increase rates; (b) better selection of risks; (c) safer flying and education in accident prevention work; (d) limit the coverage; (e) reduce loss costs and repair bills.

Each of these means has its limitations. Ordinarily an increase in rates would produce a corresponding decrease in loss ratio. On the other hand the selection is apt to become worse as the rates are increased. If higher rates are charged, a large proportion of the business is apt to come from those assureds who take out insurance because they feel quite sure of a loss during the policy period. The result is that an increase in rates sometimes acts only to aggravate the loss ratio.

The Executive Committee of the Aircraft Association decided therefore that the rates should be kept down just as far as possible and that other ways and means should be found to improve the loss ratio.

A better selection of risks will undoubtedly improve the experience. This method also has its limitations. Improved inspection service and added knowledge gained from year to year is going to make it possible for the companies to weed out the poorest risks. But the companies cannot hope to completely cure the bad loss ratio by this process alone.

The entire aircraft industry is actively interested in the improvement of flying conditions to the end that accidents will become fewer and fewer. Insurance companies can and will lend a hand in this work. Any reduction in the accident ratio will result in a corresponding improvement in the experience. A program has already been outlined for co-operation with the Underwriters' Laboratories in Chicago. This program is quite comprehensive. Types of aircraft will be rigidly inspected, and individual aircraft will be periodically examined, airdromes will be listed and graded and pilots will be licensed. It will be a little while yet before the plans are in operation, but once the program is under way the companies and the aircraft business as a whole may expect a lasting benefit.

The fourth means of improving the experience is by limiting the coverage. The deductible clause has been adopted for the collision coverage and will be continued for the coming season.

The fifth means mentioned is to reduce loss costs and repair bills. Aircraft service depots are comparatively few in number, so the expense of repair is comparatively high. The adjustment costs are slightly higher than they would otherwise be because the business is scattered around the country. It is expected that repair costs and adjustment costs will come down as the business increases.

The Executive Committee has decided on a comprehensive plan of keeping experience on the aircraft business. Most of the business is written on a six months' basis, so the majority of the year's business is fully earned at the end of December. The Association will therefore undertake to study losses and their causes. A study of the causes of accidents will not only help the insurance companies but may prove of value to the aircraft industry as a whole.

EXTRACT FROM A REPORT OF THE RESISTANCE OF SPHERES OF SMALL DIAMETER IN AN AIRSTREAM OF HIGH VELOCITY

By CAPT. TOUSSAINT and LIEUT. HAYER, Aerotechnical Institute of Saint-Cyr*

1. *Wind Tunnel.*—For our experiments we used an Eiffel type tunnel comprising (See Fig. 1):

A cone, converging at an angle of about 40°.

A working section, cylindrical, 0.30 m. in diameter and 0.66 m. in length.

A cone, diverging at an angle of 7½°.

A suction fan, actuated by an electric motor by means of a belt.

The various parts of the flue are made of sheet metal with autogenous welding and are joined together by flanges with bolts and joints.

To increase the efficiency of the fan (previously used as a blower), holes were bored round its casing in order to facilitate the evacuation of the exhaust air.

The velocity of the airstream in the working section is practically proportional to the number of fan revolutions. It reaches 90 m. per second for 585 revolutions, and for a total power of the electric motor of about 20 h.p., which corresponds to a coefficient of utilization of 2.15 including the efficiency of the engine, of its belt transmission and of the fan.

Instead of having a working section with a diameter of 0.30 m., we can have one of 0.20 or 0.40 m. This is managed by having junction flanges of convenient diameter on the converging and diverging cones.

With a working section of 0.20 m. the velocities obtained are smaller for the same number of fan revolutions than with a section of 0.30 m. Furthermore, the diameter of 0.20 m. is much too small to allow of neglecting the influence of the walls on the bodies being tested.

The steadiness of the airstream is not very good, and this makes it necessary to repeat the experiments. We observe variations of 2 to 3% at speeds of 80 to 90 m/sec. Steadiness may be improved by giving the collector at the entrance a suitable form and by placing a honeycomb at the entrance of the working section.

2. *Balance.*—We used the balance previously used by M. Maurain in his experiments on spheres (see Bulletin of the Saint-Cyr I. A. T.—No. II). It consists of a vertical frame of steel tubing, oscillating on two knife-edges fixed to a wooden stand. Two horizontal tubes fixed to the vertical frame support the scale-pan mounted on a knife-edge, and the regulating counterweight.

The whole device is very light and very sensitive (sensitiveness 0.5 gramme). The spheres to be tested are welded to a steel wire 1 mm. in diameter which can be hooked on the frame of the balance. A turnbuckle is used for giving the required rigidity to the supporting wire. The wire enters and leaves the experimental chamber by two longitudinal slots 2 mm. wide and 30 mm. long. These slots allow the wire to oscillate freely, but they also let in air. The resulting perturbation is taken into account, as stated below, by gauging the resistance of the supporting wire by direct measurement.

Remark.—The advisability of constructing an enclosed space to include that part of the tunnel containing the working section, has been considered. If that were done, the outside pressure would be in equilibrium with the pressure inside the tunnel, and thus the inlet of air through the slots would be avoided.

3. *Measuring the Velocity of the Airstream.*—The velocity of the airstream in the working section is measured by means of a micromanometer connected with a small hole bored perpendicularly through the wall of the section at a certain distance in front of the sphere being tested. The hole being thus placed, the micromanometer registers the static pressure of the stream.

We have checked the indications given by the micromanometer connected with the hole with those given by another micromanometer connected with a Standard Pitot Tube, and found them to agree. The Pitot tube in question is of the Brabbee type and gives indications of the form:

$$h = k \frac{d V^2}{2g}$$

h being the quantity of water (in mm.) read on the micromanometer,

d the density of the air,

g the acceleration of gravity.

For the Standard Pitot Tube used, we assumed $K = 1$. The velocity of the airstream is then given by the relation:

$$V = \sqrt{\frac{2g\,h}{d}}$$

At 15° and 760 mm. we have $d = 1.225$ and

$$V_{15°,\,760} = 4\sqrt{h}$$

For any conditions whatever of temperature and pressure, we shall have:

$$V_{t,\,H} = V_{15°,\,760}\sqrt{\frac{1.225}{d_{t,\,H}}}$$

From comparisons made between the indications h given by the Standard Pitot Tube and the indications H given by the static pressure opening, we have the relation:

$$H = 1.06\,h.$$

This relation holds good even when the spheres being tested are interposed in the airstream.

Remark I.—In our early experiments we measured the velocity of the airstream direct with the Pitot tube, but we had to give up this method because the perturbation caused in the stream, especially at high velocities, by the Pitot tube placed forward of the sphere reacted on it and distorted the measurements.

Remark II.—For calculating the velocity by the relation:

$$V_{t,\,H} = V_{15°,\,760}\sqrt{\frac{1.225}{d_{t,\,H}}}$$

the pressure H must be taken equal to the actual pressure of the airstream in movement. For a surrounding barometrical pressure equal to H_o, the pressure H will be given by:

$$H = H_o - \frac{d V^2}{2g}$$

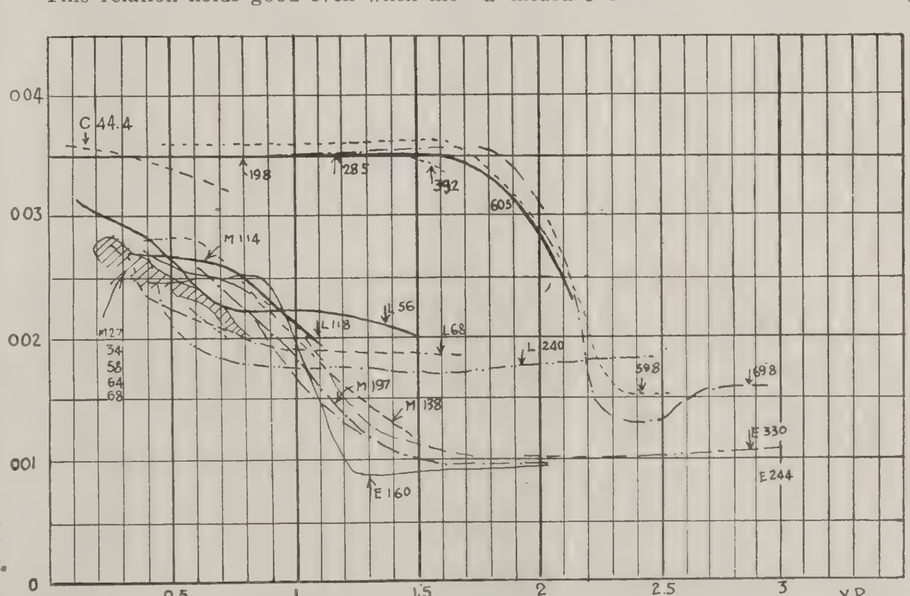
At low speeds (below 40 m/sec.), $\frac{d V^2}{2g}$ is less than 100 mm. of water, that is, 7.4 mm. of mercury. Now, H_o is of the order of 750 mm. The error in H by neglecting $\frac{d V^2}{2g}$ does not exceed 1%. The error in the speed will not exceed 0.5%.

At high speeds, the error in H and in V cannot be neglected. For instance, for $V = 80$ m., we have $\frac{d V^2}{2g} = 400$ mm. of water, that is, 29.5 mm. of mercury.

The error in H is 4% and the error in V will be of the order of 2%. It is, therefore, necessary to allow for them.

We have thus calculated the speeds, taking into account the actual pressure H.

Remark III.—The values of the total resistance R have been brought to the normal conditions 15° and 760 mm. If a measure R_{tH} has been found in any



Tests on spheres of 19.8; 28.5; 39.2; 50.5; 59.8; 69.8 mm diameter. Comparison with previous tests: Eiffel: spheres of 160, 244, 330 mm; Maurain: spheres of 27, 34, 58, 64, 68, 114, 138, 197 mm; Lioukanof: spheres of 56, 118, 168, 240 mm; Costanzi: spheres of 44.4 mm.

* Translated from the French by Paris Office, N. A. C. A.

conditions whatever of temperature t and pressure H, we have first calculated:

$$v_{t,H} = v_{15°,760}\sqrt{\frac{1.225}{d_{t,H}}}$$

we then calculated:

$$R_{15°,760} = R_{t,H} \times \frac{1.225}{d_{t,H}}$$

with d determined as stated above, and we made $R_{15°,760}$ correspond to the speed $v_{t,H}$.

4. *Previous Measurement of the Resistance of the Supporting Wire.*—We have measured for different speeds the resistance of the supporting wire placed, without sphere, in the experimental chamber.

The coefficient $K = \frac{R}{SV^2}$ calculated by these measurements varies slightly. Its mean value is K = 0.063, a figure near to those found by M. Eiffel for the resistance of wires.

To deduce the resistance of the sphere itself from the measurement made with the sphere and its supporting wire, we have taken into account that part of the wire subjected to the action of the airstream outside of the sphere.

If D is the diameter of the sphere in mm., the correction to be applied to the total measurement R_t in order to find the resistance R_s of the sphere itself, will be given by the relation:

$$R_s = R_t - R_f \times \frac{300 - D}{300}$$

The spheres tested were of polished steel. Their diameters were respectively: 19.8 mm.; 28.5 mm.; 39.5 mm.; 50.5 mm.; 59.8 mm.; 69.8 mm.

5. *Comparison With Previous Results.*—On the graph given in Fig. 2 we have laid off the values of K found in our experiments as a function of the product VR (V, speed in m/sec.; R, diameter in m.).

On the same graph we have reproduced:

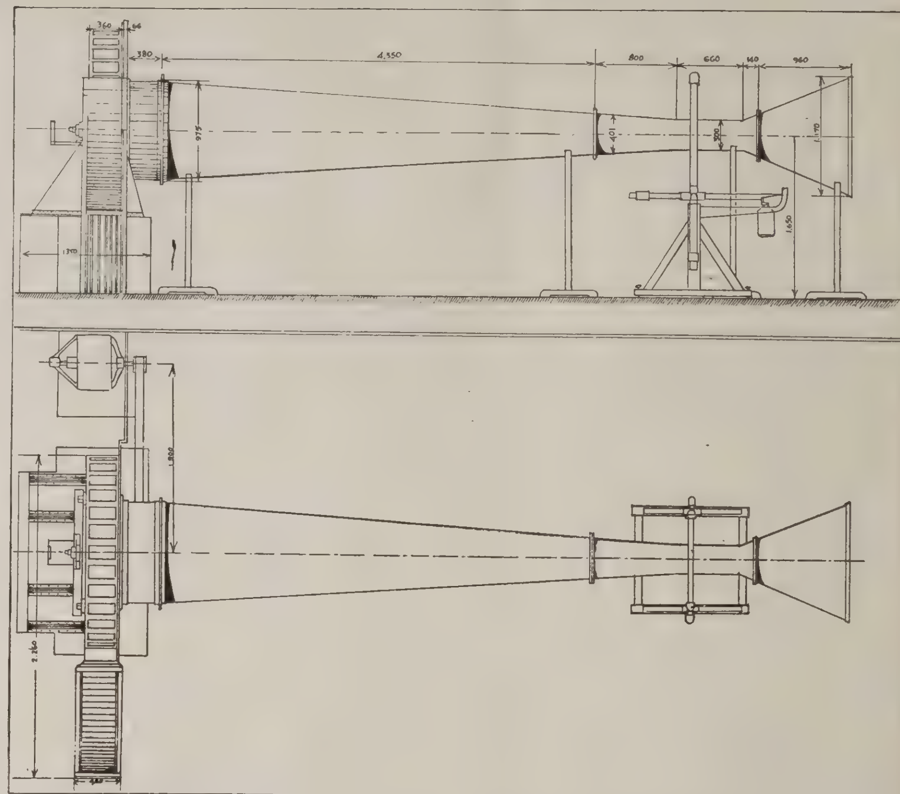
(a) The results found by M. Eiffel on spheres of 160, 244, and 330 mm. in diameter, respectively, in a tunnel with a diameter of 2.00 m.

(b) The results found by Captain Costanzi on a sphere 44.4 mm. in diameter in a tunnel 0.36 m. in diameter.

(c) The results found by M. Maurain on spheres of various diameters in a Wind Tunnel.

(d) The results found by M. Loukiannof on spheres having respective diameters of 56 mm., 168 mm., 118 mm. and 240 mm. in the tunnel of the Imperial Technical School at Moscow.

It will be noticed that there is a notable disagreement between our experiments and previous experiments, on the following points:



1st. The coefficient K before the critical speed is reached has been found notably higher in our experiments.

2nd. The product VR for which is produced the rapid variation of the coefficient K is also much larger in our experiments.

3rd. The value of the coefficient K after the critical speed is greater in our experiments than in those of M. Eiffel and M. Maurain, but smaller than in Loukiannof's experiments. Only Captain Costanzi's experiments on the 44.4 mm. sphere are in partial agreement with ours, at least so far as regards the high value of the coefficient K before the critical speed.

Discussion.—On the whole, we see that the different experimenters are far from agreeing with each other. Only the experiments of M. Maurain and M. Eiffel give results fairly analogous both as to the absolute value of K and the course of the variations of K with VR.

M. Eiffel's experiments were made in a tunnel with a diameter of 2.00 m. with an airstream not bounded by material walls.

M. Maurain's experiments were made in a wind tunnel with a Suction flue. The air drawn in escapes into the surrounding atmosphere, and at the place where the spheres are being tested it is not limited by material walls.

Is the agreement between these two experimenters due to this circumstance of the absence of material walls?

M. Loukiannof operated in a tunnel 1.00 m. in diameter with material walls, but it is to be feared that, for the sphere of 240 mm., the walls exercised a notable influence. On the other hand, for the spheres of 56 mm. and 118 mm. he worked under the same conditions as M. Eiffel for his spheres of 160 and 240 mm. There is, however, a notable discrepancy between the results of M. Loukiannof and those of Eiffel and Maurain, especially after the critical speed.

As regards our own results, we consider that the sole objection of the action of the walls is not sufficient to account altogether for the disagreement with the results of other experimenters. For the spheres of 19.8, 28.5 and 39.2 mm. the dimension of the tunnel (300 mm.) is in the same ratio as that of the Eiffel tunnel with the spheres of 160 and 244 mm.; even the sphere of 50.5 mm. is admissible by the same right as the sphere of 330 mm. in the Eiffel tunnel.

We are thus unable to explain, for the moment, the cause of these discrepancies. We consider that the question should be taken up again very methodically, defining clearly all the experimental conditions and utilizing various dimensions of tunnel for the same spheres.

SPECIAL REPORT OF THE NATIONAL ADVISORY COMMITTEE FOR AERONAUTICS

Federal Regulation of Air Navigation—Air Routes to Cover the Whole United States—Co-operation Among Government Departments

(Concluded from last week)

Results Now Being Obtained.

Prior to 1917 the Weather Bureau conducted a single observation station for the exploration of the upper air and published results of these observations more or less in detail in the Bulletins of the Mount Weather Observatory. Subsequently it issued a five-year summary of these observations, giving details of upper air conditions. These results are very valuable and were greatly in demand by artillerists, aeronauts and others during the period of the war and were quoted and referred to in connections with a great many problems dealing with free air conditions. Upon the establishment of five additional kite stations the observational data began to be published as promptly as possible in the supplements of the

Monthly Weather Review, which also were in demand and used during the perior of the war. From lack of funds the publication of the Supplement had to be suspended, but the free air data is being analyzed and studied, and a three-year summary from the six aerological stations is in process of compilation. A considerable number of special studies of free air phenomena as shown by observations have been made and the results published in the Monthly Weather Review. Systematic forecasts of conditions for aeronauts were announced to begin December 1, 1918. These have been continued ever since and very considerably extended. The whole service of the Weather Bureau in aid of aviation is in a plastic form, subject to change and development as experience and needs indicate. Specific service was rendered in connection with the trans-Atlantic flights, both of the NC-4 and the British airship, and on every occasion of any aeronautical event the Weather Bureau has been alert to make its advices and information directly available and beneficial in every way possible.

Proposals for Development

Progress in the meteorological science and its applications requires an accumulation of observational data of atmospheric phenomena and conditions over a considerable period of time.

Additional stations needed. Eight primary stations should be established at the earliest possible date, to bring the total up to 14. Including cost of equipment, salaries, telegraphing, and summarizing the results, these stations would require an annual expenditure of about $22,520 each. The total cost for the 8 stations, annually, would be $180,000. At least one additional station should be established each ensuing year until a total of 20 primary stations for the entire United States has been secured.

Actual Meteorological Service Along Air Routes.

Whenever an air route for regular traffic is established, the meteorological service necessary for that particular route should be set up even in advance of the time the air route is in actual practical operation. For each 1,000 miles of independent airway established and put in more or less complete operation the Weather Bureau should maintain a concentrated service of such route. This will require supplemental stations at intervals of about 250 miles, and the plan comprehends even additional reports from co-operative observers at intermediate points, giving visibility, local cloudiness, squalls, etc., so that at any time an aviator along the route would know the actual conditions at places toward which he may be flying. The cost of establishing and fully maintaining and operating these stations at intervals of 250 miles is estimated at $5,000 each, or a total of $25,000 for each independent 1,000 miles of air rōūte. At the present time there are approximately 4,000 miles of air routes authorized and in more or less regular operation. Meteorological reports and information are now needed for these aeronauticaal operations. In addition, flying is practiced more or less regularly over additional courses also needing the benefits of meteorological advices and warnings.

Summary

The appropriations estimated to be necessary to meet the present and prospective requirements of aeronautics within the next five years are as follows:

For 8 primary stations essential to fundamental studies of conditions in the free atmosphere..............	$180,000 00
Secondary stations for 4,000 miles of authorized air routes and for special and supplementary flying..........	220,000 00
Total	$400,000 00

Annual Extension

1 additional primary station per year for six years or until six are added	$ 22,500 00
Supplementary stations along established air routes for each 1,000 miles of continuous airway.......	20,000 00
Total	$ 42,500 00

APPENDIX D

CO-OPERATION AMONG THE VARIOUS DEPARTMENTS OF THE GOVERNMENT CONCERNED WITH AVIATION.

War and Navy Departments.

The co-operation between the Air Services of the Army and Navy Departments is provided by a Joint Army and Navy Aeronautical Board, whose duty is to prevent duplication and to secure co-ordination in the construction of aircraft experimental stations and all operating air stations used by the Army, Navy or both. All questions relating to the development of new types of aircraft and weapons to be used by aircraft are referred to the Aeronautical Board to determine which Department should properly be charged with its development. All matters of procurement and purchase of aircraft and the estimates for the appropriations for the Army and Navy aviation programs are presented to this Board for review and recommendation before submission to Congress. Training facilities are interchanged and existing law provides for the interchange of material.

War, Navy and Post Office Departments.

The War, Navy and Post Office Departments co-operate extensively in the following ways: Surplus aeronautical equipment in possession of the Army or Navy for which the Post Office Department has a definite use is transferred freely; the Post Office Department having the opportunity to obtain this material before it is offered for sale. Air Mail stations, especially those on the New York–San Francisco Airway, are used by the Army and Navy, and in turn the Air Mail Service has the use of the Army fields, repair depots and the facilities of the Naval Aircraft Factory. Army, Navy and Air Mail pilots in distress may obtain assistance and supplies from the air stations of each department without discrimination. There is complete interchange of technical and engineering data, operating reports, and general information. In addition, the Air Mail pilots and mechanics must have passed the Army or Navy aviation physical examination and in case of questions as to the physical fitness of any air mail pilot or mechanic he is re-examined by the Military or Naval Air Service Medical Departments. Other Government agencies such as the Bureau of Standards, Bureau of Mines and Weather Bureau render the technical assistance for which they are especially fitted.

Experimental and Research Development.

Co-ordination of experimental and research work is provided for by the sub-committees of the National Advisory Committee for Aeronautics. The organization of the National Advisory Committee for Aeronautics provides for sub-committees of Power Plants for Aircraft, Materials for Aircraft, and Aerodynamics. Each department of the Government, as well as the different branches of the aircraft industry, are represented in the membership of the various sub-committees. The proposed and active research and experimental development of each governmental department is reported to the sub-committees, thus preventing unnecessary duplication. The sub-committees further provide means of exchange of information and ideas which permits the industry and the various departments to familiarize themselves with the research that is in progress.

Navy and Department of Commerce.

(a) Geodetic Survey. The Air Service of the Navy is now engaged in mapping the Mississippi Delta for the Coast and Geodetic Survey, and has completed the mapping of swamps in South Carolina for the same service.

(b) The Bureau of Fisheries. The Navy has demonstrated to the Bureau of Fisheries the practicability of locating schools of fish and reporting their location to fishermen. This service has been extended to the point where it was shown that it would be practicable to maintain an airplane service for this purpose.

Navy and Treasury Department.

(a) Coast Guard. The Navy Air Service has co-operated with the Coast Guard in the training of pilots and the transfer of equipment to this organization.

Navy and Department of Agriculture.

(a) Weather Bureau. The Weather Bureau has co-operatel to the extent of its facilities in providing meteorolgical information to the Navy. A meteorological inter-departmental committee has been organized to co-ordinate the needs and services of all of the governmental departments operating airplanes.

War Department and Department of Agriculture.

(a) Forest Service. An aerial survey is being made of the recent Olympic blow-down of the State of Washington where ever 8,000,000,000 board feet of timber has been destroyed. Forest Fire Patrol will be continued and will require approximately 1,000,000 miles of flying per year.

(b) Bureau of Farm Management. Photographs have been made of agricultural districts in order to obtain photographs

by means of which farm management and development may be improved.

(c) Bureau of Entomology. Various areas have been photographed for the Bureau of Entomology and experiments are being made for the purpose of locating rust spores in the upper air currents.

(d) Weather Bureau. The Air Service has co-operated with the Weather Bureau in various capacities, especially in connection with obtaining meteorological information.

War Department and Treasury Department.

Aerial photographs of various areas are being made for the use of the United States Public Health Service.

War Department and Department of the Interior.

Geological Survey. Geological surveys are being made of various areas such as Bibb County, Ga., Greater New York, New York Harbor, 2,708 square miles in North Carolina, some 4,000 square miles in the vicinity of Los Angeles, and many other areas totaling some 20,000 square miles. For the same department the Air Service is co-operating with the Director of National Parks and the Chief of the Reclamation Service.

War Department and Department of Commerce.

Coast and Geodetic Survey. Areas near the head of the Chesapeake Bay, Atlantic City and Florida Reefs are being photographed from the air, also the coast of New Jersey, from Cape May to Sandy Hook. By means of aerial photographs a revision of the charts of the James River from Hampton Roads to Richmond and the coast lines of South Carolina, Georgia and Florida are being accomplished. Aerial photographs of various forest areas, public buildings, rivers, and cities are being taken whenever facilities become available. Among the important examples of this type of work may be quoted: forest areas of the Adirondack region and the State of Pennsylvania, public buildings and grounds of the District of Columbia, 1,200 miles of the Red River basin between the States of Oklahoma and Texas, and the Tennessee River Basin. Photographs for the Secretary of the Commission of Fine Arts are being made to aid him in planning the new botanic gardens.

APPENDIX E

CO-OPERATION OF WAR AND AGRICULTURAL DEPARTMENTS AND OPERATING COSTS OF FOREST FIRE PATROL.

By Air Service of the Army

1. These figures do not include the overhead, such as cost of initial equipment of airplanes nor personal expenses and salaries of operating personnel, which are covered in the specific Army appropriations for that purpose.

(A) Year 1921. PROGRAM COVERING CALIFORNIA AND OREGON ALONE.

Estimate of actual money expended:

(a) Maintenance of airplanes and their spare parts, 37 planes at $200 per plane	$ 7,400.00
(b) Maintenance of engines and their spare parts, 50 engines at $200 each	10,000.00
(c) Fuel and oil, based on 28 gallons per hour at $.35 per gallon, and 1½ gallons of oil at $1.00 per gallon,	
Gasoline	35,660.80
Oil	5,994.00
	$59,054.80

(B) Estimate for fiscal year, 1922. EXTENDED FOREST FIRE PATROL.

(This program will not be carried out due to lack of:

(a) Appropriations.

(b) Personnel.

(c) Instructions from General Staff adopting first alternative (that is, a reduction) of the three alternatives set forth.

This would allow the Forest Fire Patrol to include Washington, Idaho, Montana and a small portion of Wyoming, a total of five squadrons, 160 officers and 660 enlisted men.)

Estimated cost:

(a) Maintenance of airplanes and their spare parts........................	$ 54,026.00
(b) Maintenance of engines and their spare parts	47,253.00
(c) Cost of fuel and lubricants.....	115,872.00
Total	$217,151.00

N.B. This does not include the appropriation of $50,000 obtained by the Department of Agriculture for co-operation with the Air Service and forest fire protection and expended under the supervision of the Department of Agriculture and its officers.

THE FIRST AMERICAN COMMERCIAL DIRIGIBLE LINE

By LIEUTENANT C. A. TINKER, U. S. N. R. F.

WASHINGTON is to be the headquarters of the largest airship corporation in the world, with a capital of $50,000,000, backed by the strongest American financial interests in the manufacturing and technical world. Plans have just been received from Europe by Mr. Fred S. Hardesty, Consulting Engineer of Washington, for the first ship to be built by this corporation, and engineers connected with the corporation are on the way from Europe with the detailed engineering drawings to be used in its construction. The ship will be 752 feet long, 96 feet in diameter, gas capacity 3,355,000 cubic feet, 3,000 horse power, speed 80 to 100 miles per hour, disposable lift 80 tons, passenger capacity 52, and a cruising radius of 10,000 miles.

Mr. Hardesty has been prime mover in this organization, beginning his activities immediately after the armistice, when he secured from abroad the technical data and rights of the world for the manufacture of rigid airships. Associated with him is Mr. Edward Schildhauer, Civil and Mechanical Engineer, who designed the electrical equipment of the Panama Canal; Mr. Schildhauer was engineer-in-chief on the gigantic water-way, designing the operating machinery for the locks, the electric towage devices, the power plants, and other electric equipment which makes the Canal possible. Other engineers on Mr. Hardesty's staff are H. S. Jacoby, Mechanical Engineer, who will have charge of the terminal and manufacturing buildings of the corporation; Mr. Henry Harrison Suplee, Consulting Engineer, a member of the American Society of Mechanical Engineers, and the Society of Civil Engineers of France; Lieutenant Hanson E. Ely, Jr., U. S. N. Retired, who is concerned in the operating end of the enterprise. Mr. Hardesty has enlisted the support of the largest industries in the country and members of the corporation come from practically every state in the Union.

This project is founded on the proposition that rigid airships in the United States will form one of the most important elements of the national defense and on that basis the nation-wide interest in the organization was created. Air Commodore Maitland, of the Royal Air Force, Great Britain, recently stated that this corporation, having available helium as a lifting agency for airships, and relying on the inventive and manufacturing genius of the United States, together with the enormous extent of the country, will easily lead the world in rigid airship manufacture and operation. In fact, the Commodore stated that he believes that in the future, the European nations will be obliged to call on the United States for advanced designs and methods of operation of such ships.

The organization of the corporation has been made possible by a hearty co-operation of the Army, Navy, Post Office, Commerce and State Departments of the Government, without whose aid the project would have been practically impossible owing to post-war international complications.

The first line will be opened between New York and Chicago and then extended to San Francisco, with other lines radiating throughout the country as the ships are built and placed in commission. They will be the safest ships in the world. By the use of helium the fire hazard will be done away with and by using an electric drive turbo gas engine on the same principle as the electric drive in the battleship New Mexico, the machinery will be placed in the hull of the ship where it can be over-hauled en route.

The quarters for the passengers are more luxurious than the finest hotel in the country, upholstered salons, dining rooms with beautiful appointments, state rooms

with hammock beds of new design, luxurious toilet facilities, lounging rooms and smoking rooms, will make the cabin of the ship an enjoyable vantage point from which to view the scenery over the routes as the ship wends its way from air-port to air-port.

The design of these ships is the result of two years of intense investigation and will be a composite design of the best European ships with modifications resulting from research in this country. Investigations are still going on in Europe in the interests of the corporation. Mr. Schildhauer, Mr. Ely, and Mr. Jacoby, having just visited France, Italy, and Germany, and are now in England conferring with the Air Ministry in connection with the operation of mooring masts, the building of terminal facilities and other engineering features which will make the airships and air-ports of the corporation the best in the world.

It is expected that the first ship will be making regular trips from New York to Chicago and return in the early spring of 1922, immediately followed by other ships until a fleet of ten ships will be making regular schedules throughout the United States.

After the air lines have been established in this country, it is intended to commence operations across the Atlantic, those lines to be extended until the whole world is served by airship transport lines operated by this corporation.

THE ARTIFICIAL CONTROL OF WEATHER

By SIR NAPIER SHAW, F.R.S.*

IN the course of my experiences at the Meteorological Office, I have had to be responsible for considered opinions on many offers to control the weather in some form or other.

This was specially the case, but not by any means exclusively so, during the war, when it was represented in the highest quarters that the course of events showed clearly that our enemies had learned to produce rain at their pleasure and it was our duty to go one better than them by adopting certain forms of apparatus of which the efficiency was said to be beyond doubt. There is, of course, a certain amount of danger on the one hand that with the habit of regarding the atmosphere as something of which one had to ascertain the laws by observation, experiment and reasoning, one might lose sight of the possibility of control; but, on the other hand, it was generally public money that was required to set the proposed machinery in motion; and to divert prematurely towards control money that was given for discovering or verifying laws would be to waste the money as well as to make a public exhibition of oneself.

It is astonishing what people will suggest. I have not yet recovered from the astonishment of receiving from the head of an important educational establishment an offer to send to the Office a member of his staff who had an infallible method of forecasting the weather. The suggested advantage of the arrangement was that the forecasters of Meteorological Office, if they happened to be of military age, could leave their work, and "join up." The poignancy of the suggestion, so far as I was concerned, was that just before the war the copyright of a method, which I judged to be identical, was offered to me and I, wrapping myself in my scientific dignity, had not thought proper to buy it.

I propose to put before you some of the proposals for controlling the weather which came before me.

General Objects of Control

The objects of the various suggestions were curiously limited. I do not recollect any suggestions for beginning where Nature begins and turning winter into spring or summer for a particular district by warming the open air or the open sea or for drying the roads by operating on the humidity of the open air. The objects to which the operations are proposed to be directed are such as the avoidance of hail by the dissipation of thunder clouds—this appeals particularly to the regions which surround the Alps—the production of rain in regions where rain is specially wanted for the maintenance of crops is another object; and thirdly, the dissipation of fog, and this last has now become transcendently important in flying.

The methods proposed are either mechanical or electrical.

Control of Hail Storms by Noise

The mediæval tradition that the noise of church-bells, and subsequently of firearms, had a potent influence upon thunderstorms has a remarkable history. It expresses itself periodically in the vine-growing districts of Europe. It was epidemic in a very severe form at the end of last century because somebody had devised a new gun or mortar; pointed upwards, the mortar discharged a vortex ring of smoke which could be seen to reach the clouds. So popular did it become that nothing would content the people concerned but the expenditure of large sums of public money on installing batteries of these mortars, and they increased in size until they attained a height of 40 ft., about as high as a London house. A conference was held to decide whether the beneficient influence of the cannonade had been demonstrated by experience, and a vote was taken from which it appeared that the voters arranged themselves in order of the latitude of their domicile. Southerners thought the influence proved, Northerners thought it disproved, and the intermediate people thought it doubtful. So at the urgent instance of the persons concerned the Italian Government undertook experiments for two years and entrusted them to the physicist and Senator, Blaserna. By the time one year's experiments were over the epidemic had passed away, and the greatest unwillingness was evinced towards further expenditure of public funds on the inquiry.

Control by Electrical Discharge

This was at once followed by proposals for setting up paragreles in France in the form of tall structures carrying metallic points for the discharge of electricity to neutralize the electricity of the thunderclouds. I am afraid the war drew a veil over the results. I have lost sight of the paragrele industry. Its prospects were not really hopeful because there are so many arrangements which act automatically on similar lines, such as trees, kites and kite balloons. But the idea has appeared elsewhere to be applied for the purpose of producing rain.

Production of Rain by Gunfire

Another development, in a different direction, of the belief in the effect of noises is that great gunfiring, dynamite explosions or any powerful detonations produce rainfall. It draws its support largely from the fact that many battles have ended in, or been followed by downpours of rain. Historically battles are summer phenomena and doubtless many summer days of less momentous importance have closed with downpours of rain. So widespread is the general opinion that during the wet summer of 1910 the farmers of the South of England petitioned that the gun-practice of the Fleet in the Solent might be postponed until they had got in the crops, which were being ruined. I can give some good reasons for associating thunderstorms with Naval reviews in July; but I hesitate to adduce them in evidence because the storms extended from Portsmouth to London and seemed a "tall" order for saluting guns to discharge.

In countries where rain is scarce and sometimes deficient the pressure of stockowners to have something done to convert clouds into rain may be very painful. I remember being visited by a lady who begged me to say that she might spend the few remaining pounds of a fortune made in sheep-farming and lost for want of rain, in buying rockets to send out to be fired at the recalcitrant clouds which threatened rain but failed to produce it. She had already consulted a pyrotechnist who confined himself to saying that he had no actual experience of making rain, but that his rockets would certainly be as effective for the purpose as those of any other firm. A good deal of ink and paper have been expended over arguing about the effects of gunfire and other explosions. It is difficult to argue about it effectively because there is no ground *a priori* for supposing that concussion or rockets would have any effect at all upon the condensation of vapour and clouds. And in any attempt to prove the influence, by rainfall which occurred subsequently to the explosions, we have no means of comparing actuality with what would have happened if the explosion had not occurred. So we have to rely on general reasoning. As to the rain that was associated with operations on the Western Front the student of the weather maps of the time found the sequence of events always according to rule; he had no reason at all to suspect a local influence different from that of ordinary meteorological contingencies.

The effect of extensive gunfire may be regarded either as physical, arising from the detonation and thermal expansion, or chemical, due to the vast amount of material burned. The direct effect of the detonation is probably nothing at all; the thermal effect is insignificant compared with that of sunshine, and the chemical effect inconsiderable compared with the daily combustion of fuel in, say, the Manchester district.

Direct Physical Process

A certain Mr. Cole and a Canadian airman are intending to protect regions of Canada from lack of rain by spraying

*Lecture before the Cambridge University Aeronautical Society.

liquid air from an aeroplane. That is quite a different story from the use of guns. They are certain to get the condensation corresponding with the reduction of temperature caused by the liquid air during its evaporation. It is only the experiment of the condensation of water on the outside of an ice-pitcher on a larger scale; but it seems unnecessary to carry the material to a great height and indeed there is a certain risk that the rain would evaporate before it reached the ground. A millimetre of rain means four tons to the acre, or 2,500 tons to the square mile. To water a countryside would need a good deal of liquid air.

Control by Throwing Dust

Other suggestions for making rain are even less attractive. According to the Daily Mail, an attempt to produce rain by throwing dust from an aeroplane on to clouds 5,000 ft. high in order to cause rain at Pretoria was unsuccessful, as well it might be, because the conditions in which a supply of dust might be effective in causing condensation, according to Aitken, is when clouds cannot form for want of nuclei. If the clouds are already there, the dust is certainly superfluous. An identical proposal was made to the Royal Meteorological Society some years before the war, when shovelling dust out of a balloon or aircraft over London was prescribed as a means of dissipating fog.

Production of Rain by Electrical Discharge

The effect which has been alleged as following gunfire has also been claimed for electrical operations. An electrical installation in Australia for discharging electricity from kites was said to have produced enough rain to fill a large tank in a region that suffered from lack of rain; the ordinary meteorological observations of the time showed that not only the particular locality was affected but the whole country for hundreds of miles round was uniformly fortunate. And it appears to be a question of psychology whether you regard the general weather conditions of a continent as being affected by the local installation, or independent of it.

So we approach the practical question of the control of our weather with the consciousness that not even experience is allowed to be conclusive by both sides, and the views arrived at express psychology rather than pure science.

Scale of Operations in the Open Air

For one thing, these questions are questions of scale. We can do anything with a quantity of air in a small enclosure in a laboratory. We can certainly, by artificial means, make cloud or rain in the enclosure, and disperse it or evaporate it at will after it has been formed. We could easily find out whether the detonation of a pistol or a small charge of dynamite at a suitable distance would produce any effect upon an artificial cloud, though I have never heard of the experiment being tried. The important question is whether we can extend such operations from the laboratory to the open air.

We are here up against the important consideration that a cube of air, ten metres (about 33 ft.) each way, weighs more than a ton. If it is foggy it may contain 5 kilogrammes of water drops, and a millimetre of rain over the same area (about 120 square yards) weighs 100 kilogrammes. The amount of heat released by the condensation of a kilogramme of water is about 600 kilogramme-centigrade units, which is equivalent to 2.5×10^{13} ergs, or, approximately, 1 horse-power hour (2.7×10^{13} ergs). Hence evaporating fog in a 10-metre cube of air is equivalent to 5 horse-power hours, and a millimetre of rain—over the 10-metre square—represents energy to the extent of 100 horse-power hours; over a square kilometre, a million horse-power hours. Amounts of energy in these proportions have to be disposed of, or developed respectively, when the corresponding condensation is caused or reversed. With increase of scale, the amounts of energy involved soon pass beyond the limits of human control.

In order to give you a definite idea of the kind of effect which great dimensions have upon the prospects of human control, let me adduce a simple case in which dimensions are easily realized. A suggestion was made some years ago to protect the steamer routes of the Atlantic by diverting the Labrador Current. The project involved the building of a jetty 200 miles long from Newfoundland. There is nothing which can be called impossible about building a jetty a mile long, and 200 miles is only two hundred times as long. It can only be a question of money, material and perseverance. But, for practical purposes, impossibility is reached when the money and material required exceed the limit of what is available, and it is from that point of view that all proposals for the human control of weather have to be viewed.

What the Atlantic Ocean would have to say to a two-hundred-mile jetty when it was built or while it was building is another matter. It might distribute the material in a manner which differed from the specification. While, therefore, one cannot say that such an enterprise is impossible, it is not attractive in these hard times.

I have another proposal of a different character: this time to arrest and prevent the development of fog at sea by pouring oil on to the water and so stop evaporation in the environment of the ship. In this case, it is not merely the scale; the basic theory is probably at fault. The water of an Atlantic fog does not, as a rule, come from the surface on which the fog lies, but from far to the south. It is the cold surface which causes the fog; the temperature of the surface is below the dew-point of the air above it, and dew would therefore be formed on the oil. Even if the theory were correct and we obtained a patch of oil, a clear space, and a ship, we should still have to consider what would be their relative positions at the end of an hour or twelve hours, in view of their relative drifts. An identical method was suggested some years ago for application to the river Rhone, at its junction with the Saone, where warm and cold water join. No news has arrived as to the success of the proposal.

Clearances of Fog for Aerodromes

With these examples, let us turn to the modern problem of clearing fog from aerodromes. It would be a work of the most obvious utility, and even urgency, if it could be accomplished. You will permit me to pass over with mere mention a proposal which was within a little of being adopted some twelve years ago by the London County Council, to use for the purpose of dispersing the fog of London the mortars which were originally designed to convert the destructive hail storms of Italy into beneficent rain. Instead of getting £5,000 wherewith to try the experiment, the promoters only got the promise of the use of sites for placing their batteries, and the trial was never made. I cannot avoid the conclusion that this suggestion arose not from any scientific observation of the effect of detonations or smoke rings upon the fog, but from the fact that the mortar was designed as an engine for the human control of weather; the control required in London was for fogs and not thunderstorms, and anyway London could afford to pay. But for saying so I got severely criticized at the time in one newspaper.

The Effect of Wind

It would appear from experience that the easiest way of disposing of the comparatively calm fogs of an aerodrome is to get up a slight wind and blow them away. Captain Carpenter, in his report on London Fogs in 1902, found that valley fogs could not survive a second of wind at Kew beyond 13 m.p.h. (Factor 3); the same process would not work for hill-tops. Such a wind corresponds with a difference of pressure of a millibar in 75 nautical miles. A bank of air three metres high along one side of a quarter-mile aerodrome would be sufficient, and it seems rather absurd to call the maintenance of such a bank impossible. But it is so.

Dissipation of Fog by Heat

A more reasonable suggestion was made to me some months ago in a letter from a flying officer. He had noticed that the players in a football match which he was watching kept themselves clearly visible, while the rest of the ground was befogged up to a thickness of about 30 yards. He supposed that the air was dead calm, and spaces might therefore be permanently cleared by local heating. It is, however, an essential peculiarity of fog that the air in which it floats is never really still: it always has a slow drift, as anyone can see who watches a fog from the inside. In fact, if there were no drift there would be no fog problem; the drops would sink to the ground. Gravity would do the work of removing them in the simplest possible manner. It is only the eddy motion accompanying the drift that keeps the drops persistently in the air by preventing them settling. Taking the drift at two miles an hour, I made a rough computation of the coal required to clear an aerodrome 400 yards wide. It worked out at about 12 tons an hour for coal consumption for a 50-ft. fog, and ran up to 400 or 500 tons an hour, as an outside figure, to meet ordinary contingencies, using electrical distribution. Again, it is simply a question of magnitude. I have myself no practical conception of the amount of combustion which is implied by 12 tons or 100 tons an hour. My sheet-anchor about coal is that a fire in my college room used about 2 cwt. in a week of about 100 hours, or about one-thousandth of a ton per hour. So 12 tons per hour is the equivalent of 12,000 college rooms; shall we say, five times the consumption of the University and Colleges of Cambridge? Such an amount of combustion is hardly to be called impossible, but no other adjective is so nearly an expression of the facts.

"My feeling about attempting such experiments is perhaps best described by saying that the problem is about the same as trying to raise by a few degrees the temperature of the top 2 inches of the Thames between the Lots Road Power Station and Battersea Bridge when the tide has just begun to ebb. I would not like to say it is impossible with unlimited funds and coal. I do not know how much coal they burn in an hour at Lots Road, but if the plan is to be tried, it had better be on a small brook first."

Mechanical Drainage of Air

If we approach the same problem by mechanical means and endeavor to drive away the foggy air of an aerodrome by propellers capable of giving a speed of 100 kilometres per hour to the propelled

stream, we find ourselves in the same difficulty. We arrive at figures for which "impossible" is only too strong a word if you disregard all questions of cost and effort.

The Unexplored Electrical Force

But in these days we not only have the advantage of dynamical contrivances like the internal combustion engine, which packs so much available energy into so small a compass, but we are entering upon a new kingdom of electrical action which is as yet very imperfectly explored so far as the atmosphere is concerned. I have certainly heard both Sir Oliver Lodge and the Master of Trinity claim that it was possible to affect the weather by electrical operations; and one of them, I forget which, has made a certain amount of play with the disputes which will arise between neighbors in the endeavor to obtain control of the machine in their own interest. But I do not know what their practical proposals are for the direct control of the weather, so we have to go back to facts.

Once more we know that on the small scale of an enclosure within a laboratory a brush discharge of electricity will clear away dust, smoke and cloud like magic. We know that the process has been extended to the larger scale of furnace flues. There is already a company incorporated to construct suitable apparatus for clearing such flues, and the only question is whether the same process would be operative in the free air to a sufficient extent to clear an aerodrome of fog. We have, to guide us, only the records of the experience of Sir Oliver Lodge, who erected on the roof of his laboratory in Liverpool a discharging conductor for the purpose of clearing Liverpool from fog. It was an object of curious interest to all passers-by for many years. Rumor has it that it was brought into operation on one occasion, and on that occasion the space round the laboratory became clear of fog. At the same time, or nearly so, the fog cleared away from the whole of Liverpool, and, as far as I know, the experiment has never been repeated. You must form your own opinion whether it was the weather or the electricity that cleared the neighborhood of the laboratory.

Until further experiments throw new light on the subject, I think the betting is on the weather, because the operation of clearing away dust by electrical action seems to be dependent upon the brush discharge and not on the steady current of electricity carried by ions in the atmosphere. A brush discharge comes pretty near to sparking, and to make an electrical installation that is within range of sparking across an aerodrome is, if not impossible, at least a very serious matter from many points of view. We must remember that already the drops of water in the air are subject to the separating force represented by the differential effect of gravity upon the drops and the air which carries them, and therefore the force which is necessary to drive drops through the air to electrodes on either side must be large compared with the force of gravity upon the drops; that force which is already operative all the time produces no apparent effective result in consequence of the counteracting effect of eddy motion. At the moment, though not hopeful, I keep an open mind upon the possibility of clearing a space on an aerodrome by electric discharge. If you ask me for an opinion, I shall ask to put a question to you in return arising out of a suggestion that came before me during the war as a means of producing disagreeable weather for our enemies. It was to create a tornado by firing shells vertically upward in such rapid succession that they would produce a vortex with a vertical axis. Now I am particularly interested just now in the formation of tornadoes, so I shall leave this question with you: how many guns would you have to fire, and how frequently, in order to produce a tornado in the way suggested?

It is, I believe, so far analogous to the electrical question in that, apart from the ultimate destinations of the shells, it depends upon scale. The most telling example of malevolence of the weather towards the Allied Forces that I can recall in the course of the war is the development of a rainy cyclonic depression over the Western Front and southern part of the North Sea during the end of July and the beginning of August, 1917. It began to form on July 28, and reached its climax on August 3, when a well-marked depression, 11 millimetres deep, was exhibited on the map, extending over a nearly circular area 1,400 kilometres in diameter, and had filled up on August 6. It apparently originated and filled up again in the locality. I reckon that the creation of the depression, which was a very small affair, and on the map looked like gerrymandering, is equivalent to the removal from within the cylinder of 1,400 kilometres diameter of seventy thousand million tons of air. It took six days to accomplish this deportation, and three days to fill the space up again. If the enemy accomplished this feat by artificial means, they must have used some other process than firing shells vertically upwards: the question gives me the same sort of tired feeling as the 200-mile jetty, with some other sensations added.

The most direct means of accomplishing such a deportation of air would be by an underground channel to carry the air from the central region to beyond the boundary of the depression. Let us suppose a channel, twelve feet in diameter, leading from Ostend to Berlin and operated there by a 16-ft. propeller giving a full bore stream of 100 kilometres an hour (friction being neglected). The deportation would go on at the rate of 1,200 tons per hour, or 28,800 tons per day. Working without intermission, it would take 7,000 years for the propeller to complete the deportation; and as it had to be done in six days, 400,000 such channels would have to be operated concurrently to get the work done in time.

The Expenditure of Energy

What it comes to, then, is that all the suggestions for the human control of weather oppress one, not always by mistaken conception of physical processes, but by the "scale effect." Within our knowledge we are lords of every single specimen of the atmosphere which we can bottle up and imprison in our laboratories, our furnace flues, or our greenhouses; but in the open air the ordinary inexorable laws which control the behavior of the atmosphere, when we are awake and when we are asleep, have such enormous quantities of energy in the form of warmth and water-vapor in reserve that our own little reserves are not equal to making any serious impression on the course of nature.

Yet the course of the weather may be affected by what may be regarded as violent artificial means, such as the explosions of a great volcano. In a recent work by Professor W. J. Humphreys the suggestion has been put forward that cold summers and even glacial periods have been caused in that way, and I see a prize is offered for an essay on the connection between vulcanism and storms, among other things.

So perhaps we might give a new turn to our thoughts by exploring how far our reserves of available energy compare with the destruction of Pompeii, the disappearance of the island of Krakatoa, of the eruptions of Mont Pelée and la Souffrière. In any case, it is the law of conservation of energy which we have to bear in mind, and it is the vastness of the volume and mass of the air affected which has hitherto offered insuperable obstacles to the application of known physical processes for the control of weather. Any new physical process, to be successful, will have to arrange for a great economy in the energy required or give us access to supplies of energy which are not now available.

Development of Tires and Wheels

McCook Field, Air Service Engineering Division activities in the rubber materials used in aircraft construction have been mainly centered around the development of the straight side tires and wheels. A satisfactory program of wheel and tire sizes has been drawn up after considerable experimental work, and it is hoped that tire and wheel replacements will be of the straight side type, rather than of the present clincher type.

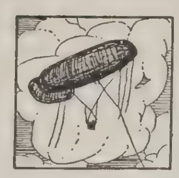
Experimental work on the development of straight side tires and wheels has extended over a period of about two years. The chief reason for an attempt to develop the straight side tire has been that the unsatisfactory performance of the climber type was most marked in the case of the DeHaviland aeroplanes, which use the 750 x 125 millimeter tires.

At best, the clincher tire has never been satisfactory, even in the case of automobiles, except in the smallest sizes. Underinflation was the chief contributing cause, as the majority of the trouble experienced was due to rim cutting. A secondary contributing cause was the type of wheel used, which is essentially an unbalanced structure.

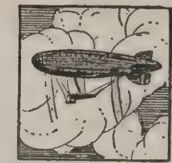
The first service test on the straight side tires was made with the 44 x 10 inch tire, used on the Glenn L. Martin aeroplane, of the type which has only two wheels. To date, the performance of these tires, and the service, which extended over a period of about six months, has been very satisfactory.

Another size which has been subjected to service conditions is the 36 x 8 inch tire, which was developed with a view to replacing the 900 x 200 millimeter size. An essential difference between this size and the 44 x 10 inch size is that the wheel for the 36 x 8 inch tire has a one piece rim, having a channel in the center to permit of the application of the casing. In general, it resembles a type of rim used on the Fokker D-7, which was equipped with a straight side tire. The wheel for the 44 x 10 inch tire has a truck type rim. This includes the removable side ring, to permit of ease of application or removal of the casing.

In every case of straight side tires, the wheel used has a hub which is centered in the wheel, as opposed to the Palmer type of off-set hub. Other sized tires are being manufactured for service test and it should not be long before complete information is available regarding the suitability and serviceability of this type, as compared to the original clincher type. It is believed, that the difficulties, experienced with the clincher type tires, experienced when used on the Palmer type wheel, will be completely overcome in the new straight side tires.



FOREIGN TECHNICAL DIGEST



300-H.P. Benz Aero Engine

The motor is equipped with twelve cylinders of 135 mm. diameter by 150 mm. stroke, which work in pairs, each upon a crank of the six-crank shaft. The normal output of the machine at sea-level is 300 h.p. at 1,800 r.p.m., the maximum output being 400 h.p. at 2,000 r.p.m. The motor drives, by means of planetary gearing, a propeller turning normally at 1,180 r.p.m. The gear case of the transmission is built direct on the end of the motor casing; the weight of the motor is roughly 3.15 lb. per h.p.

The cylinders consist of inside liners of forged steel, which are screwed into cast iron valve head castings. After testing the cylinders to an internal pressure of 425 lb. per sq. in., the cooling water jacket consisting of sheet steel of a thickness of 1-2 mm., is fitted by welding it with an oxygen flame to the cast iron end.

Each cylinder is controlled by means of one large inlet valve and two smaller exhaust valves, which are operated by tappets. The pistons are cast of the customary aluminum, copper, zinc, alloy; the outer mould consisting of metal; the core-print being made of sand.

The lubrication system consists of a plain oil circulation without any addition of fresh oil; the plunger pumps used with previous designs being replaced with gear pumps which render a simpler drive possible.

The fuel installation consists of one main tank with auxiliary tank attached, a fuel pump driven direct from the motor, a hand pump and the pressure piping of the pumps. This pressure piping also contains a fuel strainer and a release valve from which suitable piping runs to the carburretters. The piping is fitted with pressure gauge. The carburretters are arranged so that the principal air current is directed at right angles to the main jet. The fuel spray is therefore bent over at right angles, which assists a perfect vaporization of the fuel. (*Zeitschrift des Vereines deutscher Ingenieure.*)

The Potez Aeroplanes

Details of three modern machines are given as follows:

Type VIII. R.—Pilot and passenger, side by side; engine, Le Rhone, 80 h.p.; wing area, 19 sq. metres; span, 8 m.; overall length, 5 m. 90; height, 2 m. 48; weight, empty, 300 kg.; useful load, 230 kg.; total weight, 530 kg.; duration of flight, 3 hours.

Type IX.—Cabin for four passengers; engine, Lorraine Dietrich, 370 h.p.; wing area, 44 sq. metres; span .14 m.; overall length, 9 m. 81; height, 3 m.; weight, empty, 1,150 kg.; useful load, 400 kg.; fuel, 330 kg.; total weight, 1,880 kg.; duration of flight, 5 hours; speed, 200 km. per hour.

Type X.—Metal construction cabin machine; 3 engines, Hispano Suiza, 140 h.p.; wing area, 94 sq. metres; span, 18 m. 40; overall length, 12 m. 70; height, 4 m. 30; weight, empty, 1,800 kg.; useful load, 750 kg.; fuel, 540 kg.; total weight, 3,090 kg.; duration of flight, 5 hours; speed, 160 km. per hour. (*L'Aeronautique, Jan.*, 1921.)

The Spad-Herbemont Aeroplanes

Brief details are given of 18 types of machines produced by this firm, with four sketches of detail construction and photographs of the more modern types. Figures are given of the racing machine on which Romanet made the world's record (since broken by Sadi Lecointe on a Nieuport), of 309 km. per hour, the fastest kilometre being 11⅕ seconds or 321.420 km. per hour. (*L'Aeronautique, Jan.*, 1921.)

The Caudron Multimotor Biplane

The Caudron C43 is built to carry eight passengers, and has five Le Rhone engines of 80 h.p., driving five airscrews arranged thus: One in front of the fuselage, four in two tandem pairs on each wing with two tractor and two pusher airscrews. Each motor can be started from the pilot's seat. (*L'Aeronautique, Jan.*, 1921.)

Speed and Endurance of the Rigid Airship

It is known that the resistance of moving bodies in a fluid is proportional to the square of the linear dimensions and to the square of the velocity. Let C = capacity of airship in millions cu. ft.; V = velocity of the ship in miles per hour; k = a constant depending on shape of ship. Then resistance $= kC^{2/3}\ V^2$, and horse-power $\propto$ resistance $\times$ velocity $= kC^{2/3}\ V^3$.

For airships of the present streamline shape, covered with fabric of the same coefficient of friction, horse-power $= .00357\ C^{2/3}\ V^3$, and if curves are plotted from this equation for capacities up to 10 million cu. ft. and velocities varying between 60 and 100 miles per hour, it will be noted that a ship of 10 million cu. ft. capacity would require 16,400 h.p. for a speed of 100 miles per hour.

An equation for the weight in terms of the capacity may be obtained by considering each type of the structural members in turn for an airship of known weight and by increasing them in proportion to the forces acting on them, then by summing the result the total weight of the hull will be obtained. The equation will be based on the known weights of a modern airship of the Zeppelin type of about 2.2 million cu. ft. capacity. The results summed and applied to the airship under consideration give us:

Weights varying by l^4	lbs.	tons.
Main transverse frames......		
Transverse diaphragm wires.	9,000	
Circumferential wiring.......	1,100	
½ Longitudinal girders.....	5,500	
Total	15,600	6.96
Weights varying by l^3		
Fins, elevators and rudders..	2,300	1.025
Weights varying by l^2		
Fabric	15,400	
Intermediate transverse frames	2,200	
Corridor	3,000	
Total	20,600	9.2
Weights varying by l		
Diagonal wires..............	1,100	
Controls, etc.	5,000	
½ Longitudinal girders.....	5,500	
Total	11,600	5.19
Constant weights		
Control car, platforms, etc...	6,700	2.99

The above weights are for a ship of 2.2 million cu. ft. capacity. A table of weights based on these figures is given covering ships up to 15.4 million cu. ft. capacity. (E. H. Lewitt, *Aeronautics*, Jan. 20, 1920.)

Wireless Stations on Airways

A paper by D. Sinclair before the Wireless Society of London, describes the wireless telegraph service established in connection with British civil flying routes.

Some 60 per cent. of this is devoted to meteorological work. The various local reports come in at a wave length of 1,400 m., and the Air Ministry transmits the consolidated results in the form of "hourly route meteor messages" at 1,680 m. (C. W.). The remaining 40 per cent. comprises principally traffic signals. The wave length of 900 m. is reserved for radio-telephone working from machines in flight, and a constant watch is maintained during flying hours on that wave. A full description is given of the equipment and range of the three stations on the London-Glasgow route, which are 250-watt valve stations with a range of about 400 miles for telegraphy or 100 miles for telephony, as well as the equipment of several other stations and the standard apparatus employed on aircraft. (*Wireless World*, Feb. 19, 1921.)

Stresses in Laminated Wood Construction

The use of heavy and light material of the same species in laminated or glued-up wood construction has less injurious effect than has been generally supposed. Laminated wood specimens under observation at the Forest Products Laboratory show little weakening or tendency to warp from this cause. Most warping and checking in laminated construction can be traced to one of two causes. The first is the use of plain-sawed and quarter-sawed lumber in the same construction, and the second is the combination of material of different moisture content.

Plain-sawed lumber of any species shrinks and swells more than quarter-sawed lumber; and when the two kinds are glued together they pull against each other with every change in moisture content. If the block containing such a combination is kept for a long time in the same atmospheric condition, the stresses die out, because the block checks or changes shape more or less to relieve the stretched condition of its fibers. As soon as the atmospheric conditions change, new stresses will be set up.

If boards of different moisture contents are glued together, internal stresses will result from the unequal shrinkage of the boards as their moisture contents equalize through seasoning. In some blocks made at the laboratory these stresses were large enough to rupture the wood. If the wood is not ruptured, the stresses will disappear permanently in time, but the block will have changed its shape somewhat in getting rid of them.

From these facts it becomes apparent that for laminated-wood articles where strength and accurate shape are required, it is desirable to use all plain-sawed or all quarter-sawed material, to have all pieces at a uniform moisture content when glued, and to prevent as far as possible subsequent moisture changes by means of moisture-resistant coatings.

NAVAL and MILITARY AERONAUTICS

Washington - St. Thomas Marine Corps Flight

Secretary Denby authorizes the following:

Bronzed by strong winds and a tropic sun, the Marine Corps flyers on the Washington-St. Thomas test flight landed at Bolling Field April 22, having made the trip from Fayetteville, N. C., that morning. The flyers were accompanied by Major Roy S. Geiger, Lieutenant Frank H. Fleer, and Lieutenant Ford O. Rogers, each piloting a DH-4B aeroplane, which flew from Quantico to Fayetteville.

The flyers were greeted at Bolling Field by Major General Commandant Lejune, of the Marine Corps, and Captain W. A. Moffett, U. S. N., Director of Naval Aviation, and their aides.

Major T. C. Turner, Chief of Marine Corps Aviation, in command of the two planes that made the long flight, reports that flying from Washington to St. Thomas is an easy matter for DH-4B aeroplanes equipped with Liberty motors. The worst features of the trip are to be encountered along the Atlantic Coast, there being few landing fields between Key West and Fayetteville. "Flying over the western part of Cuba," says Major Turner, "is just like flying over Texas. The great sugar plantations afford landing fields in all directions."

The worst single feature of the flight was the trip across the Windward Passage, where the flyers experienced baffling, heavy gusts of wind, which made difficult work for the pilots.

"The equipment was fine," said Major Turner. "It couldn't be better. We did all of our own overhauling and inspection en route. We had one ticklish time at Camaguey, Cuba. There was no landing field near the city, and we were obliged to come down in the Plaza. The whole Plaza was covered with telegraph poles piled along in rows and we were obliged to land in between them, which was a test of our skill and of the landing gear on the planes. We escaped without damage, but it was very close work."

The total distance covered was 4,842 miles. The total elapsed time was 24 days. During 17 days of this time flying was maintained, and the actual flying time for the total distance was 46 hours and 17 minutes. The distance from Daytona to Washington is 840 miles, yet the planes were able to cover this distance in six hours and 59 minutes. The flying time from Santo Domingo City to Washington was less than that on the trip south, the actual time between the two cities being 22 hours and six minutes.

The personnel on this record-breaking flight, in addition to Major Turner, were First Lieutenant Basil G. Bradley, pilot in Major Turner's machine; Second Lieutenant Lawson H. Sanderson, pilot of plane No. 2, and Gunnery Sergeant Charles W. Rucker, who flew in plane No. 2, and was engineer for the flight.

Major Turner stated that it was a great disappointment to himself and companions not to be able to make St. Thomas, but because of the quarantine at Porto Rico, due to the presence of the Bubonic Plague, the planes did not go beyond Santo Domingo City, D. R. "We had covered the worst part of the journey," said the Major, "and could have made St. Thomas, hands down."

Naval Officers' Course Terminated at Kelly Field

The Naval Officers' course in advance pursuit training terminated officially on April 4th. Twenty-one Naval Officers, as follows, received the three months advance training after having completed their preliminary three months at the primary schools:

Lt. Commander N. H. White; Lieutenants E. L. Ericsson, R. M. Farrar, F. C. Fechtler, W. S. Hactor, F. B. Connell, A. C. McFall, R. Davison, F. W. Wead, J. J. Ballentine, C. W. Wieber, V. F. Grant, G. B. Woolley; Jr. Lts., E. P. McKellar, L. H. Lovelace, Fred T. Estabrook; Ensigns, L. W. Brown, S. W. Gallaway, G. R. Groh, Schuyler Adams, R. K. Madison, Jr.

The work given consisted of a development from the Curtiss flying into formation work from which the jump was made to solo and practice in the pursuit planes. Tactical formations were practised as soon as the "feel" of the pursuit planes was attained and after running through the list of pursuit subjects such as the protection missions, offensive patrols, gunnery, combat, etc. Special missions such as message dropping, rapid reconnaissance, altitude tests, light bombing, etc., were given a trial. Each officer, upon completing the course, was enthusiastic about it and declared that he was sorry he could not be with the group to fly the new 300 horse power pursuit planes which will soon arrive.

Reversible Steel Propeller

The most noteworthy advance in steel propeller development of recent date has been made by the Standard Steel Propeller Company, of Pittsburgh, Pa. This company, working under contract with the Government, has delivered to the Air Service, Engineering Division, an all-metal steel propeller capable of having the blades reversed.

The blades are made of steel tubing of tapering section and thickness without welding, except to close the extreme tip. The blades fit over the two arms of the hub, being held in place by means of rollers and ball bearings. These rollers greatly reduce the friction of rotating the blades about their center axis. By means of a control which extends to the cockpit, an angular movement of 45° can be obtained with little exertion. The cockpit control consists of a lever for quick reverse, in combination with the hand wheel for final adjustment in straight-away level flying.

The propeller was given a rigid test on the rest rig and later was installed in an aeroplane in which it was given several flight tests.

The idea of making a reversible propeller of steel was suggested to the Standard Steel Propeller Company by the Engineering Division. The design of the blades was made by the Engineering Division at McCook Field, but all mechanical details were worked out by the Standard Steel Propeller Company. Credit for the development and manufacture of this propeller is chiefly due to Thomas A. Dicks, of the Standard Steel Propeller Company, who formerly manufactured the Dicks-Luttress Steel Propeller, and is now with the Standard Steel Propeller Company.

Changes of Station of Officers

April 13, 1921—Lieutenant Charles B. Austin ordered to return to United States from Panama and report at Langley Field for duty, and Capt. Orlo H. Quinn ordered from Fairfield Air Intermediate Depot, Fairfield, Ohio, to Panama to replace Lieutenant Austin.

April 13, 1921—Captain Robert Kauch ordered from Mather Field, Sacramento, California, and Lieutenant Milo McCune from Laredo, Texas, to Engineering Division, Dayton, Ohio, for duty.

April 13, 1921—Lieutenant Ronald A. Hicks ordered from March Field, Riverside, California, to Kelly Field, San Antonio, Texas, for pursuit training.

April 13, 1921—Lieutenant Henry Wooldridge ordered from Chicago District Office to Air Service Mechanics School, Chanute Field, Rantoul, Illinois, for duty to replace Lieutenant Joseph L. Stromme ordered from latter station to Washington, D. C., for duty in office Chief of Air Service.

April 13, 1921—Lieutenant James Flannery ordered from March Field, Riverside, California, to Air Service Mechanics School, Chanute Field, Rantoul, Illinois, for duty.

April 14, 1921—Following officers ordered from March Field, Riverside, California, to Kelly Field, San Antonio, Texas, for bombing training: Captain Frederick B. Lafferty, 1st Lt. Park Holland, 1st Lt. Aubrey Hornsby, 1st Lt. John A. Laird, Jr.

April 15, 1921—Orders previously issued sending Captain Dudley B. Howard from Washington, D. C., to Ross Field, Arcadia, California, for lighter-than-air training revoked.

April 16, 1921—Following officers ordered from March Field, Riverside, California, to Post Field, Ft. Sill, Oklahoma, for course at Observation School: 1st Lieut. Ralph B. Walker, 1st Lieut. Walter F. Kraus, 1st Lieut. Francis B. Valentine.

April 16, 1921—Major Carl Spatz relieved from duty at Kelly Field, San Antonio, Texas, and directed to report to Commanding General, 8th Corps Area, for duty as Air Officer, relieving Major Henry C. Pratt, who is ordered to Kelly Field, for bombing training.

April 16, 1921—Following officers ordered from March Field, Riverside, California, to Kelly Field, San Antonio, Texas, for bombing training: 1st Lieut. Ames S. Albro, 1st Lieut. Thomas L. Gilbert, 1st Lieut. John E. Lynch.

April 18, 1921—Lieutenant Alfred J. Lyon ordered upon completion of present course at Massachusetts Institute of Technology, Cambridge, Massachusetts, to Engineering Division, Dayton, Ohio, for duty.

FOREIGN NEWS

Philippine Government Establishing An Air Service

Far East Aviation, the official journal of the Aero Club of the Philippines, is performing valuable service in setting forth the aeronautical activities of a section of the globe as yet infrequently heard from in that regard.

That this section is making aerial progress in a way that will cause it to be heard from more fresuently in future is evident from the reports from the Philippine Islands, from China and Japan, all of which are quoted from *Far East Aviation* for December, 1920.

It is apparent from aviation news appearing in the local press that the Philippines are by no means indifferent to aeronautics, but are watching the progress made by the rest of the world, with the intention of benefiting by the erperience of others. Realizing the benefit that the Islands will derive from an aerial system, the Philippine Government has taken the initiative in the introduction of commercial aviation.

The Government, through the Council of State, has announced that it has decided upon a plan for the establishment of an air service for the purpose of carrying the mails and improving the administration of our widely separated provinces. The services of the Filipino aviators who have been trained at the Government's expense will be utilized in this enterprise. The plan for the Government seems to be to begin operations with five seaplanes by inaugurating an aerial mail service to the Southern Islands.

The two F-5-L and three HS-2-L type flying boats which were purchased from the Navy Department sometime ago, are to be put on the Manila-Cebu line as soon as possible after their successful test flights.

Imperial Japanese Aviation

The Imperial Government Aviation Service was formerly one general unit, but has recently been formed into two departments, one under the army, the other under the navy.

The army has charge of the lighter-than-air equipment. It also has quite a number of Japanese made aeroplanes, old Curtiss, Farman, Bleriot, and Rumpler types, as well as a few machines of a later type.

When the French Aviation Mission, consisting of 20 pilots, 5 observers, and 20 mechanicians, originally sent to Siberia, visited Japan, the Government, through diplomatic channels, secured their co-operation in re-organizing and modernizing the Japanese Air Force, and also purchased several hundred of the latest type of aircraft from the French Government. The army is reported to have a total of 365 planes.

A regular aviation school is in operation at Tokorozawa while others are being established in various localities. Major General Inouye is Director of the Imperial Army Air Service, and General Arikaura is Chief of Operations.

The Department of Naval Aviation is headed by Captain K. Kamaji, I. J. N., with headquarters at Oihama. Reported to have 265 machines, the Navy is said to have purchased a number of hydroplanes from the Fernch, the British and the Italian Governments, and to have entered into a contract for 30 British Naval Instructors to arrive from England in the early part of April. Orders have been issued to give the Navy eyes by placing aboard every vessel, including colliers, as many aircraft as it is able to accommodate and launch from its decks. Base aerodrome operations will be conducted from Oihama, Kure and Sasebo. Every effort is being made to put the aircraft factories at Yokosuka, Sasebo, Kawasaki shipyard, Kobe, and Ootoiyachi, in efficient condition, and also the aircraft engine plants at Mitsubishi shipyard, Kobe. Sasebo will be the main general supply for equipping the warships with aircraft.

The Imperial Aero Club of Japan has done much to stimulate public interest in aerial mail with the result that competitions and mail flights have occurred between Tokyo and Osaka.

During the past year civil aviation has progressed considerably, and the future seems to offer bright possibilities. Beginning with about 30 civilian fliers and as many machines, mostly of local manufacture, the Imperial Japanese Air Service has begun to encourage civil flying, and allow civilians to receive instruction. There are several private flying schools now in operation, and private capital is coming forward for the manufacture of aircraft.

High Altitude Meteorological Service by Wireless

Meteorological bulletins for aeronautical purposes, prepared by the High Altitude Meteorological Department of the Prussian Aeronautical Observatory at Lindenberg, are now spread by wireless from the Königswusterhausen Radio Central Station by a 3,200 meter wave (undamped) at the following times: 6:50-7:00 a.m., 10:40-10:50 a.m., 5:00-5:10 p.m., 9:15-9:25 p.m. Each of these bulletins comprises: (1) A résumé of high altitude data as derived from pilot and captive balloon ascents as well as aeroplane observations, and expressed in a special code; (2) a summary of barometer readings over the whole of Europe; (3) weather bulletins for Central Europe; (4) a prognosis for Central Europe, special regard being taken to the requirements of aeronautics.

French Airman's Presence of Mind

The aviator Pillon and his mechanic were flying last week at a height of 8,000 feet above the aerodrome of Villacoublay, when flames burst from the motor and the machine began to rush earthwards. Pillon, however, kept his mastery over the controls, with the result that he brought the 'plane safely to the ground, in spite of the fact that his hands were badly burned. The mechanic was also seriously burned, but it is stated that he will recover.

Congo Airway Scheme

The London *Daily Mail* states that a proposal to run a seaplane service between the diamond mines of the Forminiere Company at Djoko Punda, on the Kasai, a tributory of the Congo, and Kinshasa, on the Congo, where the railway begins that goes to the steamer port Matadi-Noki, on the Lower Congo, is put forward by the directors of the mines, who offer to defray most of the initial cost. The surface of the Congo, with its tributaries, offers alighting-points almost everywhere for seaplanes or flying-boats. A survey of the route is now being undertaken, and it is hoped that the "airway" will soon be in regular operation. The entire flight from Kinshasa to the mines, 500 miles, will be accomplished in a couple of days by air, thus saving more than a month on each journey's as compared with the existing river transport.

Peking-Shanghai Air Service

The Chinese Press states that aeroplanes which are to be used on the new Peking-Shanghai air-mail service will carry 12 passengers. The trip will take eight hours, and the fare per person will be $280. A special insurance rate of $40 will bring in $10,000 in cases of fatal accident.

More Prohibitions for German Aircraft

The Inter-Allied Rhineland Commission has prohibited German aircraft from flying over the occupied areas, within which Germans may not establish aerodromes or make use of carrier pigeons.

French Prize for Helicopters

The French Aero Club has decided to offer a prize of 25,000 francs for the first helicopter that shall prove its power to rise direct from the ground in a theoretical cylinder to a height of 25 metres and return direct to the spot from which it started. The rules for the tests are to be drawn up by the Aviation Commission of the Aero Club.

Paris-Warsaw Air Service

The Paris Warsaw air service was successfully started on Tuesday, April 12, by the extension to the Polish capital of the Paris-Strasbourg-Prague service, which has been running for some months. The first aeroplane to be employed on the new airway left Warsaw at 8 o'clock in the morning with a passenger and courier and mails. Alighting at Prague, the machine picked up a second passenger and additional mails. Le Bourget was safely reached at 6.30 in the evening. The machine thus accomplished a flight of 875 miles in 10½ hours, as against a minimum of 60 hours required for the train journey.

The French "Concours Militaire"

The three-engined Farman Goliath is reported to have passed the elimination trials for the *Concours Militaire*, which require an altitude of 4,500 ms. (14,800 ft.) to be reached, and at that altitude flying at a speed of at least 110 kms. (68 miles) per hour; flying at 3,000 ms. (9,850 ft.) at a speed of 160 km. (99 miles) per hour, and flying level on two out of the three engines. Having thus qualified, the machine then entered on the final test of flying 4,500 kms. in three days. During the elimination tests the machine was piloted by d'Or, but in the duration test was piloted by M. Gonin, who was accompanied by his mechanic, Robin, and by the official observer, Lieut. Cousin. On April 1 Gonin completed his first stage by flying from Paris to Orleans and thence to St. Inglevert, a distance of 500 kms., in 3 hours 51 minutes. On April 3 he was reported to have flown from Metz to Toussus-le-Noble, the Farman aerodrome, having, apparently, flown from St. Inglevert to Metz on April 2. From these flights it would not appear that the required stipulation has been so far carried through.

New British Air Minister

In the British Cabinet re-shuffle the anomaly of a dual-headed War and Air Minister was at last remedied in the appointment of Capt. the Rt. Hon. F. E. Guest, C.B.E., D.S.O., M.P., Chevalier Legion of Honour, to be Secretary of State for Air. Patronage Secretary to the Treasury since 1917 and Liberal M.P. for East Dorset since 1911, Capt. Guest is 45, and has served in three wars—on the White Nile in 1900, in South Africa 1901-2, and in the European War 1914-16, and subsequently in East Africa 1916-17.

Dutchman Designs Airship

From Holland it is reported that a Dutchman, Herr A. Boerner, has designed a new type of airship, for which it is claimed that it is not subject to loss of gas, while the danger of fire has been eliminated without resorting to the use of helium gas, ordinary hydrogen being used. Briefly, it appears that the principle employed consists in interposing between the outer air and the hydrogen in the ballonets a layer of nitrogen. In addition to the fire-resisting qualities resulting from the nitrogen layer, it is claimed that this gas, reduces the loss of hydrogen due to diffusion to a very small quantity. As the airship is of very large dimensions—there is talk of a length of 950 ft. and 300 passengers—it will probably be a little while yet before the craft is built.

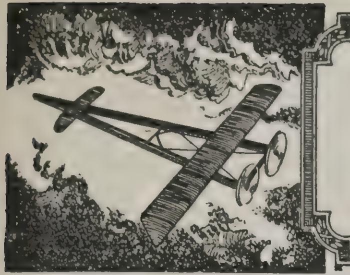
The Poles, Aircraft and the Weather Forecast

Last year a new weather theory and method of weather prediction was put forward by three Norwegian meteorologists from investigations carried out on behalf of aerial transport; and comment upon which was made in the London *Times* at the time. Our contemporary states that the sponsors claim that this theory is now ready to be put to practical use.

The theory, briefly, is that our weather depends on the interplay of two streams of air, a cold stream flowing down from all round the Pole, and a warm stream flowing northwards from the tropics. The streams meet along a shifting front surrounding the earth in the temperate zone, and our weather conditions, in the air as well as on the sea and land, are chiefly affected, according to the theory, by the strength of the Polar air-stream.

Professor Bjerknes, of Norway, thinks it would now prove well worth while for a ring of observing stations to be erected, completely circling the Pole, from the repeated observations of which it might be established, indisputably, which are the lines followed by the icy Polar air as it moves southward, and also what courses are followed by the return flows of warm air. Such observations, long desired in the interests of sea navigation, should, in Professor Bjerknes' opinion, be delayed no longer now that we are on the eve of regular transocean flying by airships and aeroplanes. He considers, also, that these Polar stations would, apart from their routine observations, prove a safeguard in North Atlantic flying owing to the fact that urgent news might be wirelessed from them, giving warning of any sudden air movement likely to presage a storm.

It would, however, be a task of great magnitude to obtain the requisite data. Professor Bjerknes himself estimates that a large number of observing stations, continuously at work, would be necessary in order to ensure that the conclusions arrived at were sufficiently accurate.



ELEMENTARY AERONAUTICS *and* MODEL NOTES

A Light-Weight Hydro Model

A FLYING hydro model of very light weight and possessing principles from which a number of aerodynamical features may be observed, is presented in the illustration below, depicting the interesting biplane designed by Mr. Arthur Heinrich. Mr. Heinrich has built numerous model aeroplanes which were studied and constructed with unusual patience and his skill as a pilot and instructor reflects creditably upon the success of his methods; it is another interesting fact that he has an enviable reputation as a designer and pilot of racing motor-boats and some of his experiments on hull designs have previously been tested out by him in model form.

This hydro model is of the biplane type with wings swept back 10°, a stagger of 1" and an overhang on the upper plane of 2½". Wing span, upper, 30"; lower, 25". The wing construction is of the single surface type with spruce beams and bamboo ribs placed 2" apart. Covering is of China silk, which is given one coat of shellac and finished with a single coat of thin varnish. Wings are set with no incidence or lifting angle. There is a gap of 4" between the wings which have a chord of 4".

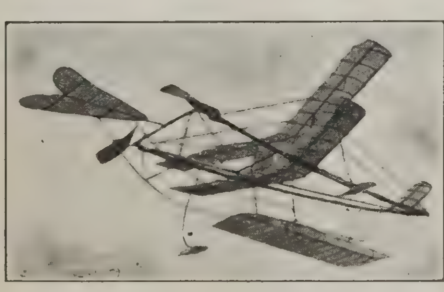
All the principal bracing is with split bamboo. Thread stays hold the top wing rigidly to the frame.

The motor frame is of ash. Two pusher propellers are each actuated by fourteen strands of 1/16" square rubber. The propellers are 8" in diameter, having a pitch which varies from 15" at the tips to 17" at the hub.

Flotation is obtained by a single main float 15" long, 4" wide and 1" deep. The float is built up with bamboo ribs 1" apart and covered with silk, doped to make it water-tight. The pontoon is carefully shaped so that the bow has a convex outline which tapers off to a concave stern. The shape of the pontoon makes it possible to do away with the "step" usually located on a pontoon slightly aft of the center of gravity. The pontoon is attached to the split bamboo framework by a rubber band shock absorbing suspension.

In order to maintain correct lateral balance on the water and to assist the lift somewhat, small wing-tip floats are provided which are carried on flexible bamboo struts. Light wires from the front of the tip floats to the leading edge of the wing assist the floats in resisting drift while skimming on the surface of the water. The front single plane is set with no incidence angle. A small rudder is used at the front of the machine, above the front wing, for directional stability. At the rear of the frame a fan-shape tail consisting of a stabilizer and elevators is braced from below in such a way as to clear the sweep of the propellers. By setting these elevators with a slightly negative or depressing angle, the stern of the machine is quickly dropped, setting the machine in the proper lifting angle for quickly rising from the water and climbing. Tests of the machine in flight indicated the extreme sensitiveness of this elevating device, and considerable care is necessary to keep it adjusted.

In flight, the machine is both speedy and stable. It rises from the water in a very short run and while not intended for making records, performs its flights with continued regularity. The usual distance covered with fourteen strands of rubber is 300 feet; flights average about 20 seconds' duration. The weight of the model in complete flying trim is five ounces, which is remarkably low for a model of this type.



An experimental biplane hydro model

New Model Aero Club to Be Formed in Canada

Mr. A. J. Hember, secretary of the Aero Club of Canada, Toronto, is interested in the furtherance of elementary aeronautics, and is desirous of interesting boy scouts, boys in other organizations and school boys in a club for the development of model aeroplane work. Officials of organizations desirous of participating in this movement should communicate with Mr. Hember at the above-mentioned address.

Illinois Model Aero Club Member Builds S.E.5

The S. E. 5 scale flying model, built by Mr. R. Jaros, a member of the Illinois Model Aero Club, has an official record of 21 seconds' duration made in a contest for gear-driven models. The wings have a span of 26", as outlined in the instruction drawings published in the December 6, 1920 issue of AERIAL AGE. The framework is built up entirely of bamboo. Wing beams, motor base and propeller are of white pine. Wheels are built up of heavy drawing paper; rudder and engine of balsa wood. The long exhaust pipes at either side of the engine are imitated by a pair of soda fountain straws which add practically no weight to the machine and which enhances its appearance considerably. The wings are covered with silk tissue paper which is drawn taut by means of a mixture of acetone and amylacetate. In a complete state, ready for flying, the weight is only 2.9 ounces.

Portland Model Aero Club's Contests

Mr. Jack Clark, President of the Portland Model Aero Club, which is the northern branch of the Pacific Model Aero Club, announces a great revival of interest in model aeroplanes in Portland, Oregon. This new club is planning to hold several large contests this year, both for land and water planes.

Compressed Air Engines Built by C. H. Lea

Several compressed air engines of two different sizes have been built by Mr. Charles H. Lea, of Akron, Ohio. Both are of the rotary type, having three cylinders. One of the engines has a bore and stroke of 5/16". It drives a 10" propeller and has flown a 36" monoplane for a distance of about 80 feet when launched by hand. It is now installed in an original 30" biplane but the machine does not perform as effectively as the first model. The tank is 1 3/5" in diameter and 12" long. It carries about 200 pounds of pressure. The complete plant, including the propeller, weighs about 4 ounces, and the complete biplane model, which has a 10" tractor propeller, weighs 9 ounces. A larger size of engine, having a ⅜" bore and a ⅜" stroke, has been built but not as yet tested with a propeller.

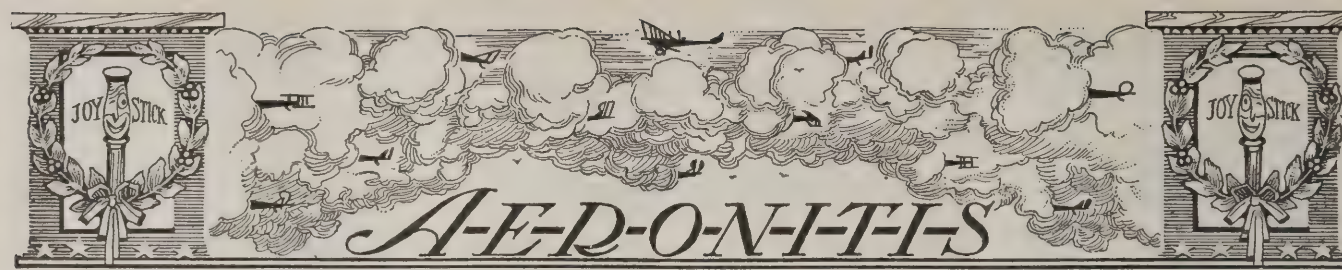
Some Notes on the Correct Uses of Silver-Solder

The silver-soldering of small parts used in model aeroplane work, especially on engines of various kinds, is an easy operation if the proper methods are followed. Practically any metal can be soldered and cold-rolled steel is especially desirable for parts required to be soldered together. Where copper tubes are joined together or fastened to the cylinders of compressed air engines, joining by silver-solder is the neatest possible method.

One of the essential points to be observed is to heat the parts by a local application of a small hot flame. As it is necessary to bring the metal to a very high temperature, in fact, until the material is cherry red in color, a distortion of the parts is apt to occur and this can only be overcome by soldering small areas at a time. Silver-solder should be dropped on the heated parts in small chips or shavings and heated until it flows as freely as liquid. Solder can be spread about by the aid of a small wire spoon. The parts to be soldered together cannot be held in a clamp because of the intense heat, so the most satisfactory way to keep them in their proper place is to bind them together with wire during the soldering operation. The surfaces must be absolutely clean if successful results are expected. Cleanliness can be achieved by the use of a flux consisting of pure powdered borax.

Experiments show that bronze is very difficult to silver-solder because after heating to the high temperature required the bronze is apt to crumple.

If very hot metal is allowed to cool too quickly it will have a tendency to warp or twist from the original shape. This can be overcome to some extent by packing the parts, immediately after soldering, in air-slacked lime which retains the heat and allows the metal to cool gradually.



WINGED SPECIE

By Robert M. McAlmon in The Ace

In the blue expanse
The wreathes build upward.

So many—Oh so many,
Hearts and bodies,
Young lives, unstained hopes,
So much meant for good
And only weak for all the intention
Have become the paleness
Of that immeasurable vapour.

And through it
Dauntless with ecstacy
Winged specie dart
To them the meek earth prays
Devoutly,
Continuous sacrificial fires burn.
Their smokes coil upwards.
Machines chant rasping psalms.

Progress is a relentless thing.
Still it is somehow
Like a slender lily
In the way it grows into the sky
Upward unfalteringly.

And is forever
Budding anew
And blossoming
With some new flower
Wet anew with the dew of creation.

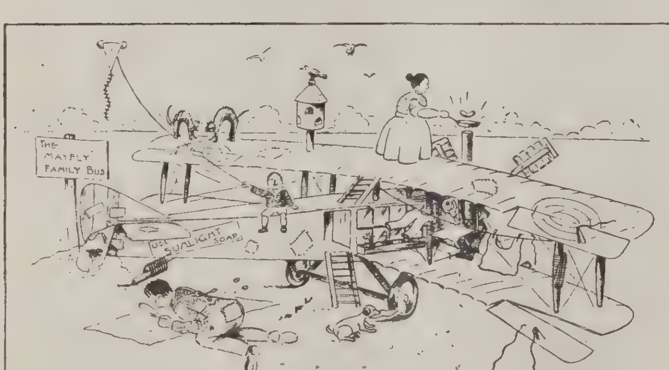
The Northwest Mounted

Over the pines where we used to go under,
All the world is white below,
With the eagle watching our flight in wonder,
On the lawbreaker's trail we go.
Thief of a Cree, with a sled full of takings,
Frenchy, who murdered a pard;
They and their kind are our combings and rakings
Since the aeroplane crew stands guard.

Over the plains where we plodded long hours
To the squeak of the snowshoe thongs,
Now we look down, as from sky-piercing towers,
While the motor is droning its song.
Weary the miles we made in the saddle;
Short are those miles today;
And yet for the pony, the sled, and the paddle,
We long as we wing our way.

—Author Unknown.

His breath is sweet
As lilac's bloom
He tried to drink
His wife's perfume.



"WHERE MY CARAVAN HAS RESTED."

Well Known Sayings

"You couldn't get me in that thing for all the money in the U. S. A."

"What's that baseball bat for?"

"Yes, I'll go up (prolonged laughter) provided you let me keep one foot on the ground."

Visitor from Denver, Colo.: "Yes, I'd like to go up but I couldn't stand the altitude."

"Oh, it's covered with leather, I always thought it was tin."

"No, I don't want to fly. I had three years of it in France and it makes me dizzy."

"Oh, look, the joy stick's turning so fast you can't see it."

"Yes, I'd like to go up but supposing
- One of them wires was to break.
- I was to fall out.
- The motor was to stop.
- The propeller was to burst.
- It fell."

Things Every Pilot Ought to Know

That when the average man refers to the fan, rudder, wheel or wing he means the propeller.

The Venturi tube is either a (1) horn, (2) periscope or (3) telephone.

To "cut a dido" or "make a flip" is to stunt.

The ailerons flop like birds' wings.

The wings are covered with (1) tin, (2) leather, (3) canvas painted with shellac, (4) silk.

The function of the propeller is to cool the motor.

I have a 10-gallon torpedo reserve tank above the centre section on my ship. I have been asked if it is a searchlight 7,829 times.

I have been told the story of the man who in the course of his first flight was asked if he would like to loop 9,789,231 times in 17 different languages.

I have been told the story of the nigger who was afraid he would have to get out and crank 8,973,201 times.

MONTE ROLFE.

1st Youngster: "Looky, Bill, see the airplane!"

2nd Ditto: "I don't see why they call them airplanes, I never seed no 'air on 'em!"

Hints for Ambitious Quartermasters, Pilots and Mechs.

It is a good idea to apply water to the radiator occasionally, as the engine functions much better when this is done. Much motor trouble can be avoided by supplying the engine with gasoline.

Always see to it that the wings are attached securely, as they have a nasty habit of coming off.

Do not try to fly tail first or sideways, as it is not considered proper in aviation "circles."

Before going on a flight see if the machine is equipped with such things as a fuselage, recording altimeter, and airlons. Perhaps you don't know what these things are, but they are handy things to take along.

Do not wear a straw hat or derby, as they have an unpleasant habit of coming off. This is very embarrassing.

Tail spins in dirigible flying should be avoided whenever possible, *as better men than you have tried it without success.*

Don't worry about landing; *you'll come down all right!*

Always ask for a cigarette upon landing, as this impresses the spectators.

Always have an alibi ready when you make a bad landing and smash the landing gear.

A New Song

(Tune to "Bubbles")

I'm forever flying airships,
Powerful airships through the air;
We fly so high, nearly reach the stars,
Then, like my dreams, we glide away.
Misfortune's always hiding,
I've flown everywhere;
I'm forever flying airships,
Powerful airships through the air.

—F. A. S.

AERIAL AGE WEEKLY

OL. 13, No. 10 MAY 16, 1921 10 CENTS A COPY

The Speedway at Los Angeles, Where the Aero Club of Southern California Will Hold Its Aerial Meets This Summer

Sport in the Air

LISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
criptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

G. DOUGLAS WARDROP
Editor
B. C. BOULTON
Contributing Technical Editor
G. F. McLAUGHLIN
Contributing Technical Editor
NORMAN E. JENNETT
Art Editor
H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIII NEW YORK, MAY 16, 1921 NO. 10

Sport in the Air

UNDER the auspices of the Aero Club of America, sport in the air is to take a new lease on life during the coming summer. The commencement of the Club's program will be the formal opening of the new club-house at Hazelhurst Field, Long Island, on May 15, for which there has been arranged a very comprehensive program of aerial events, as reported in our last issue.

The residents of the American metropolis had little opportunity last year of seeing anything in the nature of an aerial exhibition of proper magnitude, and it is encouraging to know that the Board of Governors of the Club are arranging a series of Saturday and Sunday matinee races which will provide New Yorkers a real opportunity to become acquainted with, and enthusiastic over, aeronautic progress.

Night Services in France

IT would seem that France is going to lead the world in the establishment of night flying services. Commercial aviation in France, under the direct encouragement of the Government subsidy, seems to progress apace more and more. It has been realized that if commercial aviation is to rival its competitors by land and sea it must be capable of giving services all round the clock, so to say. That is, it is no good for the company engaged in operating aerial services to say it is very sorry, but it is impossible to carry passengers and goods to a certain destination by a certain time because flying by night is not a practical proposition. Trains and steamships can run at night, and if the aeroplane is to compete with them it must be able to fly during the hours of darkness. As a matter of fact, there is no particular difficulty about night flying, given that the necessary arrangements are made and are in order. These arrangements consist in lighthouses to guide the aviator on his way, and adequately lighted landing grounds to accommodate him on his arrival at the intermediate and terminal ports of landing.

France, as a part of the program she has set out to complete in order that she may retain her lead in the air, is busily completing arrangements for lighting the various aerial routes she already has in operation. Lighthouses are presently to be erected on the Paris-Warsaw, Paris-Amsterdam, Toulouse-Casablanca, Paris-Strasburg, and Paris-London routes. The last, on the French side, is to be put in hand forthwith, and the Strasburg route is being surveyed with the same object, so that it is more than possible that the present summer will see night services established on these two lines, if not on any of the others.

It is true that our Air Service has placed an order for its first experimental aerial lighthouse, but it will be some time ere it is completed, and longer before it is in service.

The First Plane in Flight

THE aeroplane is twenty-five years old today. It was on May 6, 1896, that Dr. Samuel P. Langley took his invention to Quantico, on the Potomac River near Washington, and launched it. It flew 3,000 feet in eighty seconds and returned to the ground. On a second flight it went 2,300 feet. This machine weighed only twenty-seven pounds and was propelled by a one horse-power steam engine, but it proved the soundness of the theory, upon which Langley and other scientists had worked for years, that mechanical force could compel the flight of a body heavier than air.

This initial success of Langley's was soon lost in the spectacular failure of a fifty horse-power machine, built upon the model of his first plane, but made large enough to carry a man. This craft plunged into the Potomac on its first trial in 1903, when a part of the launching apparatus broke. Langley's fame went with it, not to be recovered until 1914, when Glenn Curtiss took Langley's "failure" from the Smithsonian Institution, and, adding only an efficient launching device, made the plane fly across Lake Keuka.

But as Langley was dead before Curtiss vindicated him the only really great thrill the veteran scientist had was the one which he experienced twenty-five years ago today. What a pity it is that he could not have lived, as Edison, Bell, Marconi and other great inventors have lived, to see the perfection of his device and its remarkable effect upon the world!

Dr. Langley's tiny plane stayed in the air eighty seconds; the planes of today remain aloft a whole day. His device flew 3,000 feet; aviators now cross the continent in a few hops and fly six miles high. The aeroplane, modelled on the very theories which Langley proved to be practical in 1896, was one of the deciding factors in the war. It would have been of deep sentimental interest to Langley, whose first experiments in aerodynamics were generously supported by the late William Thaw of Pittsburgh, if he could have seen a later William Thaw fly into battle in France in the plane over which he dreamed and toiled so many weary, unrewarded years. [Editorial in N. Y. *Herald*]

The News of the Week

Army Carnival at Mitchel Field

A crowd of 15,000 spectators witnessed the aerial carnival staged by the Army Air Service at Mitchel Field on May 8th. The weather conditions were pretty nearly ideal.

During the morning there was a display of machines and equipment and in the afternoon the pilots and men got busy and put all their apparatus into action—much action.

Capt. Harry Smith started the afternoon's events by leading a flight of five planes in V formation in a roaring dash around Mineola, Garden City and Westbury. On the wings of the V were Lieuts. Victor C. Beau, Jr., Arthur E. Simonin, Howard N. Norris and Eugene H. Barksdale. The big De Haviland planes swept through various manœuvres, as if the five ships were flown by a single man. They roared low enough over the crowd to make the more thoughtful reflect what would happen if these planes were equipped with their war quota of machine guns and bombs.

The next event was completely over the heads of the thousands around the field—so far above their heads that no one saw it happen. While Capt. Smith and his aerial cavalcade had been charging around through the lower atmosphere another De Haviland, with Lieut. Fonda Johnson at the controls and Sergeant Jean Riviere in the gunner's cockpit, had been making altitude. At 12,200 feet, a height at which only the keenest-eyed could see the plane, Sergeant Riviere stepped out.

According to regulations Sergeant Riviere should have counted three as he plunged downward before jerking the ring his hand was clutching. Whatever he did, he cleared the tail of the machine, which was shooting along at close to 100 miles an hour, before the parachute pack attached to his back opened and his fall was stopped by a severe but welcome jolt, which meant that the silk life preserver had opened. After that all he had to do was to land, which he did near the middle of the field after drifting a mile or two horizontally and two vertically.

Another thriller was a triple jump from one plane by Lieuts. Johnson and Beau and Master Sergeant Jones. Beau and Johnson, who were clinging to the outer ends of the upper wings of the De Haviland, jumped first, and soon after them Jones dived overboard from the rear cockpit.

Stunting honors went to Lieut. Barksdale, who took up an SE-5 and did everything but turn it inside out. The stunt which "got" the crowd was a tail spin which started at about 1,000 feet. The plane whirled in a swift drop to perilously near the earth, and then slid out of the spin, straightened out and "zoomed" up out of danger. He also looped, barrel rolled and did a few things nobody could describe.

While all the military machines were cutting capers, four planes of the Curtiss company were soberly carrying passengers on sight seeing hops over the green and brown surface of Hempstead Plain. "Casey" Jones and Dick Depew, Curtiss pilots, handled two vivid orange orioles and Lieuts. Roullot and Simonin flew two others. Although life is just one hop after another to Pilot Jones, he included reporters in his list of passengers and kindly refrained from stunting. Those who drew lucky numbers on their programmes were passengers.

Another machine which attracted much attention was a plane with a new monoplane wing of the internally braced type designed and built by the Lawrence Sperry Aircraft Company of Farmingdale.

Altogether there were in the air the following machines: 15 DeH-4s, 2 S. E. V., 2 Curtiss J.N., 4 Curtiss Orioles, 1 Messenger, 1 Sperry monoplane, 2 Junkers, 2 Fokkers, 1 S. V. A., 1 Young, 1 Farman, 1 Standard J1.

Federal Control of Aviation to Be Discussed at S.A.E. Summer Meeting

No air transportation service has as yet been successful from the standpoint of returns on the investment. But how can we expect the aeroplane to be a money-maker when it is only twelve years old? The railway and the automobile at the same stage of existence did not have greater earning capacity. An authority like V. E. Clark, Chief Engineer of the Dayton-Wright Company, will be heard with considerable interest when he discusses this question at the Aeronautic Session of the S.A.E. Summer Meeting. His point of view will take this form: What must be done before air transportation will become a serious factor in the transaction of business?

Government legislation is recognized as the greatest need in commercial aviation today and the paper on this subject by S. H. Philbin, patent counsel for the Wright Aeronautical Corporation, is therefore very timely. Mr. Philbin's discussion of the nature and scope of immediate Federal legislation will meet with serious consideration on the part of those who are endeavoring to establish air transportation as a vital commercial factor.

The existing types of aircraft engines will be criticized from the standpoint of military and commercial requirements in the paper on Aviation Powerplant Development, by G. J. Mead and L. E. Pierce of the Wright Aeronautical Corporation. The trend of future design will be outlined, and stress laid on the necessity of coordination of the work of the plane and engine designer in the creation of a more efficient and more reliable power unit.

To take in everything from an inspection trip to a military ball within the space of twelve hours will be the experience of the members of the S.A.E. who participate in the visit to McCook Field, Dayton, Ohio, on May 21st. The date is particularly convenient for those who plan to go right on to the S.A.E. Summer Meeting at West Baden, Ind. This visit to McCook Field is the first joint aeronautic session of the American Society of Mechanical Engineers and the Society of Automotive Engineers.

A talk at 10 o'clock on the general nature of the work at McCook Field will open the day's program, followed by an inspection trip through the laboratories and shops of the Field. This will end on the flying field where the standard types of aeroplanes in use by the Air Service will be exhibited and will also be flown if the weather allows.

After luncheon the technical session will begin in the auditorium, when talks will be given by members of the McCook Field organization, and some of the new Air Service motion pictures will be shown.

C. F. Kettering will be one of the speakers at the dinner in the evening at the Dayton Engineers' Club that is being arranged by the Dayton Section of the Society for the visitors, and the Military Ball at the Miami Hotel at 8:30 will come as the grand climax of the day.

Automobiles will meet all trains arriving after 7 A. M., carrying guests from the headquarters at the Miami Hotel to McCook Field. Information will be available at the railroad station, the Miami Hotel and the Dayton Engineers Club. Major Thurman H. Bane, of McCook Field, is the chairman of the committee in charge of this joint visit, and Glenn L. Martin, Major G. E. A. Hallett and Joseph A. Steinmetz are serving on the committee with him.

Washington to New York with Ten on Board

The Santa Maria, a giant seaplane of the Aeromarine Company, arrived in New York from Washington. The big flying boat landed in the Hudson River at Eighty-third street and was moored there. There were ten persons aboard. Three were members of the crew. Captain T. L. Tibbs was pilot. The ship first flew to Hampton Roads, where a landing was made. Passengers lunched with officers

U. S. Air Mail Planes, Pilots and Mechanics at College Point, Maryland

of the fleet. Among those on board were: Captain Moffett, director of Naval Aviation; his son, George; Commander and Mrs. Robnett and their son, Vernon, and Samuel McFarlane, of New York.

Aero Club of Southern California July Meet

Special racing aeroplanes, designed and built in California, for the express purpose of "twisting the dials off their air speed indicators", are to be the leading features of a two-day aviation meet which the Aero Club of Southern California this week announced will be held on July 16th and 17th, the last two days of the Elks' Convention. This meet will be held at the Speedway at Beverly Hills. The Speedway is being especially fitted up for aviation meets, making it one of the most advantageous flying fields in the country. The man-eagles, one might say, will entertain the man-Elks.

The plans of the coming event, although scarcely out of their cradle, indicate that it will be second in national importance only to the Pulitzer Trophy races scheduled for Detroit in September.

The tentative prize list, which those in charge of the meet intimate is subject to material expansion, calls for $5,000 which will be divided among the winners of probably a dozen different flying events.

At least half of this sum will be awarded to the winners of a special race for local planes, designed and built for and powered exclusively with the familiar and universally popular Curtiss OX-5 motors of 100 h.p. To qualify in this event the planes must be capable of attaining a speed of at least 100 miles an hour. This will eliminate all of the fat and comfortable "Jennies" and other two-passenger planes, few of which have done more than ninety miles an hour under even the most favorable circumstances, and clear the atmosphere for the special racers which are to be constructed for the event.

Prominent local sportsmen, a number of whom have recently become members of the Aero Club and who are getting all excited at the prospect of owning their private racing craft, are definitely known to be arranging for the construction of at least three tiny air burners.

The designs have already been approved and construction started on one of these machines at the shops of the Pacific Airplane and Supply Company in Venice. The backers of the plan, whose names will not be announced until its completion, are known to be two of the city's most prominent business men and sporting enthusiasts.

Few details of the racing craft are forthcoming, O. W. Timm, the designer, being inclined to favor interrogators with a sly glance of excessive wisdom and the obvious statement that it will be powered with an OX-5 motor.

Contracts for the second and third planes have not yet been given, although it is understood that they will be signed and construction started by two other local manufacturers within a week or ten days. Other negotiations at present under way point to a total entry list of at least ten, and possibly more, locally built racers.

The Army and Navy will be invited to participate in the Speedway program, and it is possible that one of the two days will be devoted exclusively to events for the service aviators. A tentative proposition is being drawn up to be submitted to the Government, and, basing conclusions on the splendid co-operation afforded in the recent Long Beach meet, planes from Rockwell, March and Mather fields will play an important part in the program.

Secretary Wagner of the Aero Club is also compiling all available records for altitude flights by planes of different types and variously powered engines so that attempts may be made to shatter as many of these records as possible. Wagner is especially anxious to send the Kinner Airster after an altitude record for planes equipped with 60 h.p. motors, as it has already reached more than 15,000 feet in official tests, and is said to be capable of several hundred feet more.

UNITED STATES POST OFFICE DEPARTMENT AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, March, 1921

DIVISION	Gasoline	Grease and Oil	Repairs and Accessories	Miscellaneous	Motorcycles, Trucks	Rent, Light, Fuel, Power, Telephone and Water	Office Force and Watchmen	Pilots	Mechanics and Helpers	Radio	Departmental Overhead Charge	Interest on Investment	TOTAL	SERVICE AND UNIT COST				
														Gallons of Gasoline	Total Time Run	Total Miles Run	Cost per Hour	Cost per Mile
New York-Washington...	$2,010.42	$450.16	$2,808.26	$869.83	$799.40	$606.07	$1,140.27	$1,132.17	$2,730.39	$274.99	$223.54	$873.74	$13,919.24	5,704	hr. min. 185 04	15,324	$75.21	$0.91
St. Louis-Twin Cities...	2,928.13	709.62	*6,924.51	2,997.60	607.81	797.04	2,215.03	3,080.57	4,112.88	824.96	670.63	1,032.85	26,901.63	8,236	320 02	26,631	84.33	1.01
New York-Cleveland.....	3,526.96	709.21	†8,828.75	2,717.38	1,607.06	581.39	1,797.40	2,568.23	3,244.45	549.97	447.09	983.33	27,561.22	9,787	314 14	26,129	89.46	1.05
Cleveland-Chicago......	2,408.18	536.32	‡5,877.15	2,098.81	647.30	399.33	1,285.01	1,988.94	1,340.75	412.48	335.32	624.97	17,954.56	6,646	213 51	19,032	84.60	.94
Chicago-Omaha.......	3,023.16	658.51	1,035.46	1,668.79	868.95	384.75	1,160.53	1,802.43	1,957.71	549.97	447.09	358.31	13,915.66	8,443	227 43	20,210	61.66	.69
Omaha-Salt Lake.....	5,690.66	1,366.92	§5,016.16	2,938.50	898.11	469.81	1,732.49	4,097.12	3,497.83	1,145.77	931.44	675.00	28,459.81	17,907	471 28	45,551	60.68	.62
Salt Lake-San Francisco.	3,308.66	539.59	3,041.23	4,536.95	1,403.67	554.15	1,939.61	3,181.78	3,028.91	824.96	670.64	700.00	23,730.15	10,206	371 14	33,748	65.13	.70
Totals and Averages......	$22,896.17	$4,970.33	$33,531.52	$17,827.86	$6,832.30	$3,792.54	$11,270.34	$17,851.24	$19,912.92	$4,583.10	$3,725.75	$5,248.20	$152,442.27	66,929	2,103 36	186,625	$73.18	$0.82

*Includes cost of new motor plane No. 128.
†Includes cost of new motor and new set wings on plane No. 183.
‡Includes cost new engine section panel No. 202 and one new motor on plane No. 129.
§Includes cost of new set of wings plane No. 184.

Planes operated on New York-Washington Division:
Curtiss R4's, equipped with Liberty 12 motors.
De Havilands, equipped with Liberty 12 motors.
Breguet, equipped with Renault motor.
L.W.F., equipped with Issota-Fraschini motor.
Curtiss JN4D's, equipped with Curtiss OX5 motors.
(Used for testing pilots.)

Planes operated on St. Louis-Twin Cities Division:
Standard, equipped with Hispano-Suiza motors.
Curtiss JN4H's, equipped with Hispano-Suiza motors.
Twin De Havilands, equipped with 2 Liberty 6 motors.

Planes operated on New York-Cleveland Division:
Curtiss HA, equipped with Liberty 12 motor.
De Havilands equipped with Liberty 12 motors.
Twin De Havilands, equipped with two Liberty 6 motor s.
L.W.F.'s, equipped with Issota-Fraschini motors.

Planes operated on Cleveland-Chicago Division:
De Havilands, equipped with Liberty 12 motors.
Twin De Havilands, equipped with two Liberty 6 motors.
Martin, equipped with two Liberty 12 motors.
Curtiss HA's, equipped with Liberty 12 motors.

Planes operated on Chicago-Omaha Division:
Curtiss HA, equipped with Liberty 12 motor.
De Havilands, equipped with Liberty 12 motors.
Twin De Havilands, equipped with two Liberty 6 motors.

Planes operated on Omaha-Salt Lake Division:
De Havilands, equipped with Liberty 12 motors.

Planes operated on Salt Lake-San Francisco Division:
De Havilands, equipped with Liberty 12 motors.

COST PER MILE

Division	Overhead	Flying	Maintenance
New York-Washington......	$0.26	$0.23	$0.42
St. Louis-Twin Cities......	.23	.25	.53
New York-Cleveland........	.23	.26	.56
Cleveland-Chicago..........	.19	.26	.49
Chicago-Omaha..........	.19	.27	.23
Omaha-Salt Lake..........	.12	.25	.25
Salt Lake-San Francisco.....	.18	.21	.31
Entire Service............	$0.19	$0.25	$0.38

OTTO PRAEGER, Second Assistant Postmaster General.

The AIRCRAFT TRADE REVIEW

Aeromarine Service in the North

After a more than successful season in the Southern district, where U. S. mails and several thousand passengers were carried in perfect safety and comfort for a distance of 376,000 passenger miles between Key West and Havana, also Miami, Palm Beach and the Bahama Islands, the Aeromarine Airways, Inc., is now ready to carry out its operations in the Northern district, along Long Island Sound, the New England shore resorts and the New York lake resorts, in conjunction with the scheduled runs of New York to Boston, New York to Newport, New York to New London, New York to New Haven, Albany and Atlantic City, and the popular aerial sight-seeing tours of Manhattan Island.

The season is being started with six large 15-passenger flying cruisers, and a number of 6-passenger open cockpit and enclosed cabin flying boats. No effort has been spared to make these ships the most comfortable and the most attractive of any in commercial use today.

Following is the schedule of flights in the Northern area:

New York to—	Miles	Min.	Rate
Atlantic City	105	90	$50.00
Boston	260	200	125.00
Newport	130	100	65.00
New London	105	90	50.00
New Haven	72	60	40.00
Bridgeport	60	50	30.00
Albany	145	120	75.00

Special rates for commuters' service.

Aerial sight-seeing tour of New York, 30 minutes over Manhattan and New York Bay, $25.00.

Special flight around the Statue of Liberty (15 minutes), $15.00.

Aeromobile Exhibited at Atlanta Section of the Association of Civil Engineers

H. E. Thaden, of the Thaden Aeromobile Manufacturing Company, exhibited a small model of his flying aeromobile which aroused considerable interest amongst the members of the association. The novelty in this machine seems to consist mainly in that a rotary motion has been given to bird-wing action, which is minus the resisting upstroke and automatic in its functioning as controlled by the pilot. When further tests have been made we shall publish a more complete description of the device.

Personal Paragraphs

F. G. Ericson of Toronto was elected chairman at the annual meeting of the International Powerboat Union, held at the Chicago Yacht Club, succeeding Charles P. Hanley of Muscatine, Ia.

S. V. A. Limousine Makes New York-Chicago Flight

Chicago—The six-passenger S. V. A. limousine which left New York May 7 arrived in Chicago May 8, having spent seven and one-half hours in the air. The plane carried passengers and freight.

The plane made Cleveland in approximately four hours. It left Cleveland at 10:30 A. M. and reached Chicago at 3:45 o'clock.

Lloyd Betraud was the pilot. The passengers were Ralph Diggins, owner of the plane; Miss Jessie Bradley, A. D. Breck and Charles Dickinson.

Airliner in Accident

Milwaukee—With one of its wings hitting a tree on the take-off of what was to be the maiden trip, the Lawson air liner crashed fifty feet to the ground May 8. Four passengers, including Alfred W. Lawson, the designer, escaped uninjured. Damage to the machine was estimated at about $8,000.

Blame for the accident is placed on the field at South Milwaukee, which is called both small and "soft." The plane took off about 6.30 A. M., with Mr. Lawson and Charles Wilcox as pilots and Carl Schory and Andy Surini as mechanicians.

In banking the ship the lower left wing struck a tree, the impact throwing the huge machine against a telephone pole.

Mexico-Texas Air Mail

Mexico City.—An aerial mail and passenger service between Tampico, Mexico, and Houston, Texas, was approved April 29 by President Obregon.

The concession was granted at the request of the Houston Chamber of Commerce.

Caproni to Build New Triplane

As has already been reported in Aerial Age, the giant Tandem Triplane, constructed by Senior Caproni, which was wrecked on Lake Maggorie, is to be replaced by another machine of similar type which is now under construction. The Italian Government, which has become very much interested in the results of the experiments before the recent accident, are to assist Caproni financially to construct for the Government a ship along the same lines, but the new model will be just one-third of the original machine.

With the Barr Flying Circus in Japan. Peter Maraschi, pilot; G. Kushibiki, Japanese manager, and J. R. Schmitt. The circus is being enthusiastically received

Air Service Bids

BALLOONS—Procurement Office, Air Service, Washington. Bids are wanted until 10:30 A. M. May 16, circular No. 71, for four observation balloons of the Avorio-Prassone type, capacity 37,500 cubic feet. For information address above.

AIRSHIP NET—Procurement Branch, Air Service, Munitions Building, Washington. Bids are wanted until 2:30 P. M. May 18, circular 82, for 1 airship net. For information address above.

PUMPS—Procurement Branch, Air Service, Munitions Building, Washington. Bids are wanted until 3:30 P. M. May 17, circular 86, for 12 double action hand rotary pumps. For information address above.

BLEACHING COTTON CLOTH—Procurement Branch, Air Service, Munitions Building, Washington. Bids are wanted until 3:30 P. M. May 16, for services in finishing 150,000 yards semi-bleached cotton balloon cloth. For information address above.

SUPERSTRUCTURES FOR STEEL HANGARS—Air Service, Procurement Branch, Munitions Building, Washington. Bids are wanted until 2:30 P. M. May 16, circular 78, for 3 superstructures for standard steel balloon hangars, 45x45x120 ft. Address above.

BRONZE PADLOCKS—Air Service, Munitions, Building, Washington. Bids are wanted until 2:30 P. M. May 23, circular 88, for furnishing 600 2-in. cast bronze padlocks. Address above.

CONNECTING ROD—Engineering Division, McCook Field, Dayton, Ohio. Bids are wanted until May 20, circular 21246, for 14 connecting rod assemblies. For information address above.

CRANKSHAFT—Engineering Division, Air Service, McCook Field, Dayton, Ohio. Bids are wanted until May 20, circular 21245, for 2 crankshaft assemblies. For information address above.

RUBBERIZED BALLOON FABRIC—Air Service, Procurement Branch, Munitions Building, Washington. Bids are wanted until 2.30 P. M. May 21, circular 87, for 1,600 yards special rubberized fabric, 3,250 yards do aluminized, 150 rolls aluminized outside tape, 150 rolls inside tape, 6,000 yards rubberized aluminized airship fabric, 1,600 yards do, 360 rolls airship tape, 400 rolls do, 850 yards rubberized fabric, 250 yards do, 500 yards do, 50 rolls outside tape and 55 rolls inside tape. For information address above.

SUPPLY BALLOONS — Air service Procurement Branch, Munitions Building, Washington. Bids are wanted until May 31, circular 89, for 20 5,000-cu. ft. capacity supply balloons. Address above.

VERTISCOPES — Air Service, Procurement Branch, Munitions Building, Washington. Bids are wanted until 2:30 P. M. May 17, circular 84, for 10 vertiscopes. Address above.

TWO AIRSCAPES OF THE AVIATION COUNTRY CLUB OF DETROIT

The Aviation Country Club of Detroit grounds comprise 832 acres, which completely surrounds two lakes and adjoins another. The small lake with the little island in the center is Flanders Lake, the one in the foreground is Green Lake, and the flying field is shown in the upper left hand corner of the lower illustration. The club house can be seen amongst the trees in the upper picture

INFLUENCE OF SPAN AND LOAD PER SQUARE METER ON THE AIR FORCES OF THE SUPPORTING SURFACE

By A. BETZ.

Translated from Technische Berichte by Lt. Walter S. Diehl, Bureau of Construction and Repair, U. S. N.

IT should be clear that in order to obtain a lift it is necessary that the air which flows past an aerofoil be given a downward acceleration; indeed the lift can be only the reaction produced by the downward acceleration of the flowing air. The motion of the air in the neighborhood of an aerofoil may be followed theoretically with great exactness. In the following, it will be undertaken to make understood, through the simplest possible considerations, the effect of span and loading on the air force on an aerofoil, and while these do not form a strong proof of the correctness of the formulae developed, yet they explain the essential features of the phenomena.

One may obtain a practical mental picture of the flow in the region of an aerofoil by imagining that at a given instant a horizontal surface behind the wing is moving downward with a velocity w. This surface has a breadth equal to the span b and extends to an infinite distance to the rear of the aerofoil (*infinite* in relation to the point from which the flight of the aerofoil began). The qualitative course of such a flow requires no special difficulty in presentation. The entire air column above and below the surface partakes of the downward motion, although the velocity will be less and less as the distance from the surface increases. In order to further simplify our investigation let us pass from this infinite air mass, with its velocity decreasing to zero, to an air mass of finite boundaries which is in uniform motion with the velocity w. Let the breadth of this air column be b and its height be h.

The lift A is equal to the vertical momentum imparted to the air per second, or to the product of the mass by the vertical velocity. Since in each second, a mass equal to $(\frac{\gamma}{g}\, bhv)$ is affected by the aerofoil and is influenced anew (the hypothetical board becomes v m. longer each second), the imparted vertical momentum and therefore the lift, is

$$A = \frac{\gamma}{g}\, bhvw$$

where

$\frac{\gamma}{g}$ = air density,

v = velocity of flight.

Concerning the magnitude of the effective height h, we can not be certain without experiment. Yet it is clear that it may be expressed in multiples of the breadth of the board, i. e., of the space b. We can therefore say that

$$h = \kappa b$$

The vertical velocity behind the aerofoil is then given by

$$w = \frac{A}{\frac{\gamma}{g} \cdot \kappa b^2 v}$$

If we introduce the impact pressure

$$q = \frac{1}{2}\,\frac{\gamma}{g}\, v^2$$

and the surface F, it is

$$w = \frac{v}{2\kappa} \cdot \frac{A}{qF} \cdot \frac{F}{b^2}$$

where $\frac{A}{qF} = c_a$ the lift coefficient and b^2/F is the mean aspect ratio of the aerofoil. (If the chord t is constant $F = bt$ and $\frac{b^2}{F} = \frac{b}{t}$). The velocity w prevails some distance to the rear of the aerofoil in the path of flight, at some distance forward the air is yet undisturbed. It is therefore permissible to assume that at the aerofoil a vertical velocity of w′ prevails and that its value is between o and w. Considerations of similarity lead to the conclusion that this velocity may be taken proportional to w so that we obtain

$$\frac{w'}{v} = \frac{1}{2\kappa} \cdot c_a \cdot \frac{F}{b^2}$$

if $\kappa' = \kappa \frac{w}{w'}$

Ordinarily the vertical velocity w′ will not be constant over the entire aerofoil. Its variation along the span will depend upon the distribution of lift along the span. The more exact consideration* of the actual course of the streamline and their influence upon the coefficients shows that in the best case the vertical velocity is constant along the span; κ' therefore has the value of $\pi/2$. This occurs when the distribution of lift along the span is proportional to the ordinates of a half ellipse (see Fig. 1). From the usual performance of aerofoils it appears the mean value of κ' previously derived, is not essentially different from this best value. We can therefore see that the formula

$$\frac{W'}{v} = \frac{1}{\pi} \cdot c_a \cdot \frac{F}{b^2}$$

using the best value for $\frac{W'}{v}$ which is possible for the given proportions (lift and span) gives very accurate approximations for the normal aerofoil. Pronounced deviations are to be expected if the aerofoil is strongly washed out or if the sections at tips are essentially different from those at the center (Taube).

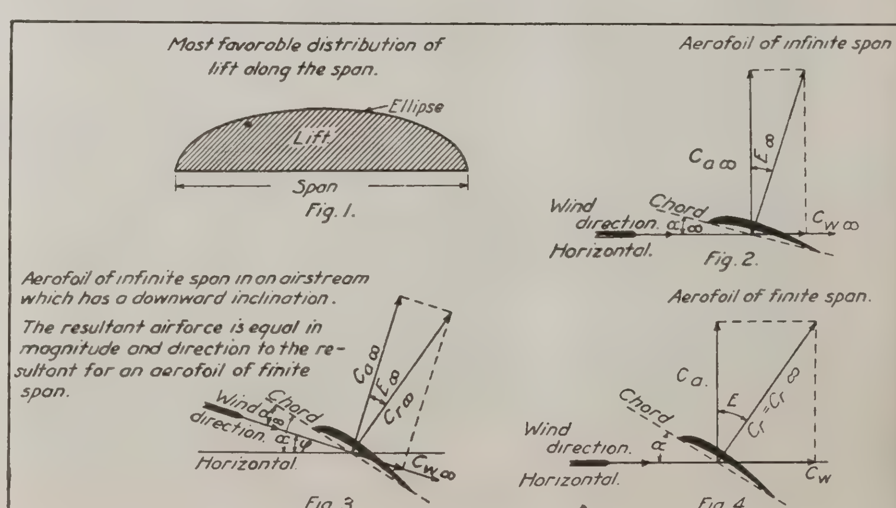
The aerofoil is in an airstream deflected downwards by its motion. The tangent of the angle of inclination of this airstream to the horizontal has the mean value $\frac{w'}{v}$. It is on one hand proportional to the lift coefficient $c_a = \frac{A}{qF}$, and on the other hand approximately proportional to the mean aspect ratio $\frac{b^2}{F}$. The inclination will be zero if there is no lift, and also for all lifts in the case where the aspect ratio is infinite. As a result of this latter condition the aerofoil of infinite aspect ratio has special significance because after a fashion it supplies a normal form to which the force on a chosen aerofoil in an undistorted airstream, without the disturbing influence of a deflected airstream, may be compared. The force on an aerofoil of finite span is therefore the same as that obtained on an aerofoil of infinite span placed in an airstream which has the inclination of $\frac{w'}{v}$. The calculation is made according to the following outline, in which the angle of inclination of the airstream is denoted by ϕ $\left(\tan\phi = \frac{w'}{v}\right)$ and the angle of the chord of the aerofoil by α. The values for the aerofoil of infinite span are denoted by the subscript α.

The aerofoil of infinite span at the angle of attack $a\alpha$ has a lift coefficient of $v_{a\alpha}$ and a resistance coefficient of $c_{w\alpha}$; the resultant is therefore $c_{r\alpha}$ (Fig. 2). In order to find the force on an aerofoil of finite span one must next obtain the angle of inclination ϕ from the equation

$$\tan\phi = \frac{1}{\pi} \cdot c_a \cdot \frac{F}{b^2}$$

(Since the lift coefficient c_a of the aerofoil of finite span is very nearly equal to $c_{a\alpha}$, the value $c_{a\alpha}$ may be used to calculate ϕ.)

* Originating in the thorough research of Prof. Prandtl that whenever the lift varies along the span vortices are always formed especially in the proximity of the wing tips and are distributed in an approximate straight line behind the aerofoil. It is assumed that the "field" set up by these vortices give the actual course or direction of the air motion.



If we now consider the entire figure to be turned through the angle ϕ (Fig. 3) we obtain the picture for the aerofoil of finite span in a horizontal airstream (Fig. 4). In order to obtain the lift and drag coefficients for the aerofoil of finite span, we now need but resolve the resultant c_r which has been given the additional inclination ϕ into its vertical and horizontal components c_a and c_w. From the customary small angle approximations ($\cos \epsilon = 1$, $\sin \epsilon = \tan \epsilon = \epsilon$) there result the following simple formulae

$$a = a\alpha + \phi$$
$$c_a = c_{a\alpha}$$
$$c_w = c_{w\alpha} + c_a \,.\, \phi$$
$$\frac{W}{A} = \frac{C_w}{c_a} = \left(\frac{W}{A\alpha} + \phi\right)$$

in which

$$\phi = \frac{1}{\pi} \,.\, c_a \,.\, \frac{F}{b^2}$$

There is one fact which is not taken into account in these formulae, but it is practically of slight importance: the vertical velocity w′ of the deflected airstream at the leading edge of the aerofoil is somewhat less than that at the trailing edge, the airstream is therefore somewhat curved. Accordingly, it is necessary that the aerofoil of finite span be more deeply cambered than the aerofoil of infinite span in order that they may have the same resultant force.

2. *Practical Formulae*

It quite frequently happens in practice that it is desired to obtain the characteristics of an aerofoil of given aspect ratio when we have the data on the same profile for another aspect ratio. Denoting the coefficients for one aerofoil by the subscript 1 and those for the other by 2, we have the following equations which give the desired result if we compare each surface with the aerofoil of infinite length, using the above formulae, and take the difference of the results.

$$a_2 = a_1 + \Psi$$
$$c_{a2} = c_{a1} = c_a$$
$$c_{w2} = c_{w1} = c_a \,.\, \Psi$$
$$\frac{W}{A_2} \quad \left(\frac{W}{A_1}\right) + \Psi$$

in which

$$\Psi = \frac{1}{\pi} \,.\, c_a \left(\frac{F_2}{b_2^2} - \frac{F_1}{b_1^2}\right)$$

The results of these calculations do not give the air-force on the two aerofoils for the same angles of incidence. Ordinarily this is no objection since the values may be plotted in a curve of air force against angle of attack, which may be extended to cover the entire range of angles for the new aerofoil.

NOTE.—The angles are measured in radians. They may be converted to degrees by the use of the factor, 57.3, for example:

$$a^\circ = {}^\circ\alpha + 57.3^\circ\,\Psi.$$

THE FRIESLEY FALCON

THE Friesley Falcon is a twelve-passenger twin-motor plane of the Pullman Cabin type.

The first public test flight was held Sunday, April 17, at Friesley Field, Gridley, California. Considering the attendance, lack of accidents of any kind and the complete success of the Falcon's test flight, the event was one of the most successful ever held in California. The crowd was conservatively estimated at 17,000 and when it is considered that Gridley is situated out in the heart of the Sacramento Valley, far distant from any city of size, the attendance is remarkable and shows the interest being taken in the aviation in Northern California. Sacramento is 70 miles air line and San Francisco 130, and rain in the morning frightened off a large number of people who otherwise would have attended. Visiting army and civilian planes from Mather, Crissy, Durant and Redwood City Fields lent an aspect to the meet that made it compare favorably with meets held at some of the large airdromes. Among the visiting fliers were Capt. Eddie Rickenbacker, Capt. Lowell H. Smith, Lieut. Halverson, Lieut. Jones, Reed Chambers and A. Andrews.

The "Falcon" left the ground after a run of less than 100 yards at a speed of 45 M.P.H. and during this flight developed a speed of 90 M.P.H. with motors throttled to 1,500 R.P.M. The balance proved to be perfect and the ease of control, glide and landing exceeded the expectations of the designer. The plane landed at 40 M.P.H. and rolled less than 200 feet. The success of this first public flight is all the more remarkable when it is considered that only two private test flights had been made and those on the day previous and of a duration of about 2 minutes each.

The designing, building and flying was all handled by B. M. Spencer, former air service officer, lately stationed at McCook Field. Mr. Spencer designed and constructed his first plane (a two-passenger) late in 1914, and flew it for some time prior to the war. He is a Brown University man and in addition to his technical experience he has had 3,000 hours flying time and is also possessed of remarkable mechanical ability, of which the workmanship embodied in the "Falcon" is remarkable evidence.

The specifications are as follows:

Power Plant—

2 Liberty 12 cyl. low compression motors.

Principal dimensions—

Over all Span	65 ft. 3 in.
Over all Length	40 ft. 0 in.
Over all Height	15 ft. 0 in.
Chord	7 ft. 6 in.
Gap	7 ft. 6 in.
Wing Curve	U. S. A. No. 5
Angle Inc. top plane	3 deg.
Angle Inc. lower plane	2 deg.
Decalage (wings)	1 deg.
Stagger	None
Sweepback	None
Dihedral	None
Angle Stabilizer to chord	1 deg.
Range of adj. of Stabilizer	–1 to –5 deg.

Wing and control surfaces—

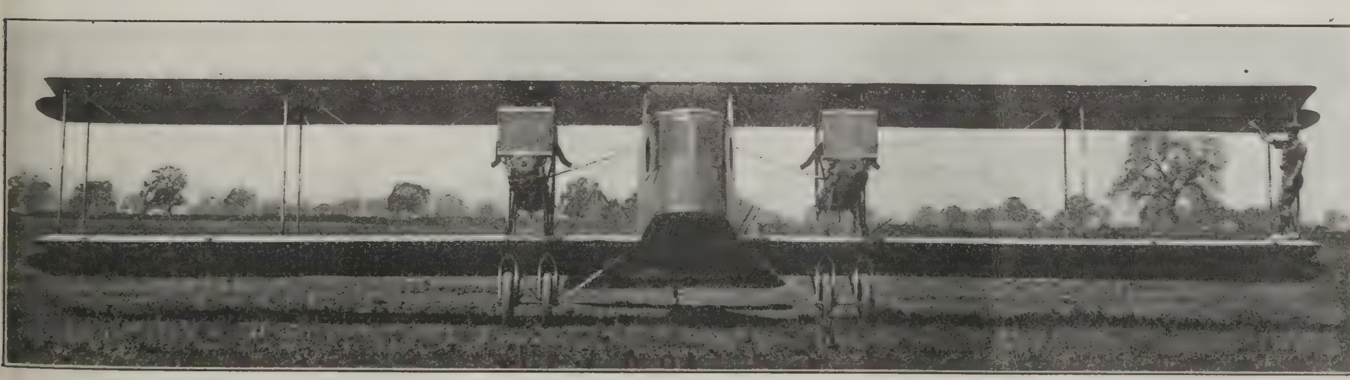
Total area main planes	897 sq. ft.
Area Ailerons (each)	30 sq. ft.
Number ailerons	4 sq. ft.
Area Fin. (each)	13 sq. ft.
Area Rudder (each)	16.6 sq. ft.
Number Rudder	2 sq. ft.
Area Stabilizer	53 sq. ft.
Area Rudder (each)	16.6 sq. ft.

Weights and performance—

Weight empty	5600 lbs.
Weight loaded	8600 lbs.
Weight per sq. ft.	9.3 lbs.
Weight per H.P.	12.3 lbs.
Maximum Speed	120 M.P.H.
Minimum Speed	55 M.P.H.
Climb to 5000 ft.	4 Min.

A more detailed description follows:

The body is completely enclosed and houses twelve wicker chairs so placed that there is a space of 20 inches between, and as the body is 56 inches in the clear in width a good wide aisle is to be had. The average large plane neglects the head room, which has been overcome in the design of the Falcon. The head room in the clear is 5 ft. 8 in., allowing the average person to stand erect. There is no cross bracing of any description, allowing the body to be readily adapted to freight or express, with few changes. The pilot's cockpit is in the extreme nose, as this portion of the cabin extends out a considerable distance in front of the wings the visibility is exceptionally good. Celluloid ports are also provided in the roof, giving the pilot a good view overhead. All instruments are arranged on a dash imme-



The Twin Liberty Friesley Falcon

diately in front of the pilot. Storage batteries for the motors are placed under the dash and are readily accessible.

The fuselage truss wiring is made up of 3/16" 3% nickel steel rods threaded right and left hand and terminating in clevises on each end. Longers are solid spruce from nose to tail post with bolted on tie wire fittings. Where the fittings fasten to the longer is placed a hard wood block, glued and screwed and finally covered with tape.

The tail end of fuselage is covered with plywood from a point slightly in front of the tail skid section to the tail post. From the nose to a point immediately in the rear of the baggage compartment. From this point to the beginning of the plywood on the tail is cloth.

Tail skid is of steel tubing hung to a frame, also made of steel tubing that fastens to all four longerons. The shock is taken up by means of cord.

One of the most unique features of construction is to be found in the means of rudder control. Instead of the conventional wires running into the fuselage, allowing long flapping wires, the control is conspicuous by its absolute lack of wires of any description. Fastened to the rudder are short horns on which are pivoted two rods; these rods terminate in a semi-circular sliding yoke of steel tubing, that slides back and forth through a fitting mounted on the tail post. This yoke is actuated by the rudder control wires, which are completely enclosed in the tail. This allows a very clean cut tail structure and a minimum of resistance. The elevator control wires pass out of the tail and lead directly to the horns on the elevator, the total amount of exposed control wire being about two feet on each side.

Rudders and ailerons are balanced. Ailerons control wires are run along the leading edge of lower wing, the bottom wire continuing straight through and the wires to the wheel tapped on at a point just outside of the body.

Just before the initial flight of the 12 passenger Friesley "Falcon". Left to right: B. M. Spencer, Chief Engineer Friesley Aircraft Corp., designer, constructor, and pilot of the Falcon; Miss Alyse Mortiverdi, who christened the plane; Capt. Lowell H. Smith, Mather Field; Miss Betty Jellinck, Capt. Eddie Rickenbacker, H. M. Friesley; Reed Chamber, Durant Aircraft Corp.; Lieut. H. Halverson, Crissy Field; L. C. Taylor, Rideout Bank

Fuel is carried in storage tanks under the floor of cabin and is pumped to gravity tanks of 40 gallons each above the motors. The overflow is fed back through sight gauges in the pilot's cockpit.

Oil tanks are situated on the engine bearers immediately back of the motors.

Propellers used are paragon of 9 ft. diameter and 7 ft. pitch.

Baggage compartment is located at the rear of the rear seats and is 4 ft. x 5 ft. x 4 ft. in size.

The stabilizer is adjustable by means of two screws controlled from the pilot's seat by means of a hand wheel.

Landing gear is very substantial and is of the double yoke type housing two Atlas spring wheels, two on each side directly under the engines. Elimination of shock absorber cord and the weakness of construction using same have been successfully overcome.

Full results of the final tests will be published as soon as completed.

BETHLEHEM AIRCRAFT CORPORATION "SKYLARK"

THE BaCo Skylark was designed to fulfill a variety of uses. It is a two-passenger, side by side seater, with dual control, making it ideal for passenger, cargo or instruction work.

The passenger acquires greater self-confidence and pleasure when sitting alongside of the pilot in seeing the ease with which the machine is controlled. The ability to converse freely without the aid of a speaking tube or the sign language is a valuable asset.

The BaCo Skylark

The great inherent stability of this machine and slow landing speed make it one of the safest machines produced to date. When the control stick is released the machine will settle by itself to its natural flying angle, which may be varied by the adjustable stabilizer. It will do this from either of the two extreme positions of a stall or vertical nose dive. It is also laterally stable, so that it may be flown indefinitely with "hands off" the stick.

A model was tested by the Bureau of Standards to prove the theory of this design and construction; yet it does not differ from standard and accepted practice.

The adjustable stabilizer assures a balanced machine in flight regardless of load, eliminating excess strain on the pilot. All surfaces are large and answer to the slightest touch, but are not over sensitive, assuring maximum control at minimum flying and landing speeds.

The machine is easily entered by two steps. A low step on to the wing and another low step into the cockpit through the side door entrance in the body.

The control stick and rudder bars are of the standard type. The roomy upholstered cockpit with an attractive instrument board, presents a pleasing and comfortable compartment for the pilot and passenger.

To carry a few hundred pounds of mail, express or luggage, instead of a passenger, the extra seat is pushed back, or removed, and the control stick removed; giving ample cargo space.

The corporation's first aeroplane was designed by Garret B. Linderman, 3rd, E. M., Engineer and Vice-President, and tested out by Bruce Eytinge, Sales Manager, during October, 1920, when 18 test flights were made, proving that the actual performance of this two-passenger machine, with only 60 h.p. air-cooled engine,

is better than that of machines with much greater horsepower. This is chiefly due to the fact that the entire aeroplane is very efficient, and light, but yet maintains a high safety factor of 9.

The new model as herein described and illustrated, was given its initial test flight May 2nd, 1921. The pilot's statement is as follows:

"At 7:45 P. M. I opened the throttle and took off up a long steep grade into a light west wind; not even a test hop, I simply took off and cleared the telegraph wires by 400 feet which were 1,800 feet from my starting point. The engine ran perfectly at 1800 r.p.m.

"I circled around, climbing to 3,000 feet over Bethlehem, and after feeling out the machine in turns and observing all instruments, I throttled down, approaching the field by S turning and a slow flat glide, clearing the high tension power wires by a few feet, and, as my observers said, made a perfect three point landing at 7:55. It is the most practical aeroplane I have ever flown or tested."

The power-plant, a Lawrence, 3-cylinder, radial, air-cooled engine of 60 h.p., efficiently blends into the nicely streamlined body, only exposing the cylinders for cooling purposes.

This engine has gone through the standard 50-hour Army test. It is supported by two steel plates, one on either side. These plates are bolted to the vertical veneer nose panel, which in turn is braced by two veneer tie-panels to the longerons which eliminate all cross bracing wires in the first two sections, giving a very strong mounting.

Ample space is provided around the dual ignition systems and oil leads, to the engine. A fire wall separates the engine and ignition system from the gasoline tank and cockpit. This so-called fire risk is absolutely eliminated because the carburetor hangs outside and underneath the engine, doing away with the collecting of any overflow gasoline. If a backfire occurs, the live flame would be dissipated in the open air by the propeller blast.

A 20-gallon gravity tank provides fuel for over four and one-half hours at a cruising speed of 70 miles per hour.

General Dimensions

Span, both planes	29′ 10″
Chord, both planes	48″
Clear gap between plane	60″
Stagger	20″
Length, overall	23′
Height, overall	8′
Wing Curve	U. S. A. 27
Total wing area	214 sq. ft.
Dihedral, both wings	1½°
Weight, empty	700 lbs.
Useful load	600 lbs.
Loading per sq. ft.	5 lbs.
Loading per horse power	19.3 lbs.
Maximum speed	90 miles per hour
Minimum speed	33 miles per hour
Flight duration	4½ hours
Climb, full load	600 feet per minute
Ceiling	18,000 feet
Gasoline tank capacity	20 gallons
Oil tank capacity	2 gallons

General Description

Main Planes

Four aileron type, of even span. Wing section U. S. A. 27 set at an angle of one degree incidence on the upper wing and zero degree incidence on the bottom wing, and at 1½ degre dihedral. No sweepback.

Wings are in four units. Top wings are joined together and supported in the center by two inverted "V" streamline steel struts, giving the best possible vision to a side by side seater, easy access to the cockpit and eliminating the center section. They are held in position at the center, longitudinally, by a streamline steel strut. Internal lateral control mechanisms are accessible for inspection through aluminum covered openings in the wings.

Front spars are of selected spruce, 4-ply laminated rectangular sections. Rear spars are of "I" beams sections of spruce. They are built up so as to form a section similar to the ordinary routed spar. It consists of two spruce members of shallow "u" shaped with the bottoms of the "u" side by side, and with a center piece of 1/16 veneer, the grain running vertically.

Cap strips of the spars are of birch ⅛″ thick. Their construction is very logical, since the veneer takes the horizontal shear across the grain, and the cap strips of birch utilize a material of high strength where the fibre stress is greatest.

The internal bracing system is of double swaged wires and forked ends attached to mild steel fittings bolted to the main spars which are left solid at these points. Main plane fittings are of standard and simple design, made up of plain mild steel sheet metal. Ample strength has been allowed on all fittings and no off-center wire pulls are present anywhere in this machine.

The trailing edge of the wings is formed of wire; simple to make and easy to attach. This wire trailing edge also entails a saving in weight and allows the exact contour of the wing to be obtained by bringing the trailing edge to a sharp, clean finish. Hand-holes are provided on both lower wings to facilitate handling on the ground.

The wing truss is very logical and of clean design. The single "I" struts which are laminated and built up of spruce are of very generous proportion.

The double lift wires, front and rear, are of stranded cable. They run forward, as well as inward, serving both as external drift wires and flying wires. The landing wires extend from the front of the cabane in the center to the front and rear of the bottom of the interplane struts. This places the rear landing wire out of the way of entrance to the cockpit. This, together with the strut running from the center of the plane, from the top of the cabane to the forward part of the fuselage, completes the truss for stress of every character, while at the same time reduces the paraside resistance to a minimum; nevertheless, the use of the deeply cambered U. S. A. 27 wing section enables the weight of the wing truss to be kept down to a minimum.

Wing frames are covered with approved grade A cotton fabric and special care has been exercised in sewing the fabric to the ribs in accordance with Army specifications. Surface treatment is of six coats of Phenix fireproof dope with a bronze finish.

Fuselage

The body is solidly constructed. A complete trussing is provided of four solid spruce longerons with diagonal bracing members also of spruce. The whole is covered with mahogany, 3-ply veneer. Although very light, the fuselage has a strength far in excess of that required either in the air or on landing. Great care has been exercised not to weaken the fuselage at the point where the door to the cockpit is placed. Special diagonal and longitudinal members being provided at that point to carry the truss through.

The smooth mahogany finish is particularly pleasing to the eye and touch. A veneer fuselage of this type eliminates all fittings and provides a good production job easy of repair. The combination of veneer with the complete wooden truss also eliminates all tendency for warping or distortion of veneer.

Empennage

The empennage is very well built, as shown in the accompanying illustration. The stabilizer is hinged on the rear end so that a large degree of adjustment is possible in flight. Since the balance of the machine is perfect, however, it is expected that the stabilizer adjustment will only be used when the pilot wishes to fly at one particular flight attitude for a long period of time.

The stabilizer has a strong rear spar running continuously over-top of the fuselage. The laminated front edge is in one piece of semi-circular shape, three ribs on either side give it adequate strength and preserve the camber required. A strong spruce member runs on either side of the fuselage from the forward point of attachment of the stabilizer towards the outer end of the rear spar. Two wires run from the top of the rudder post to the outer end of the stabilizer spar, giving added security for severe manoeuvres. The stabilizer and rudder are of similar construction and are well braced internally. The elevator horns are skillfully disposed within the vertical fin and a particularly strong tortion tube is provided to carry the elevator loads to the elevator horns. The design of the empennage is particularly sturdy and clean and combined with simplicity.

Chassis

The chassis is constructed of ⅝″ by 1½″ oval steel tubing brazed to a guide plate which allows 4″ travel of the axle. The shock absorber cord is simply wound about two spools, provided on the axle,

Side view of BaCo Skylark

and down under the guide plates. The cross wiring for the chassis struts is provided on both the front and rear struts. Two compression tubes run between the lower end of the front and rear struts. The chassis is very simple in construction and can be dismounted and assembled in a few minutes.

Cockpit

In the cockpit ample room is provided for two persons side by side, together with dual control. The instruments are symetrically arranged on a dash board clearly seen by either occupant. The engine controls, namely, switch, altitude adjustment and spark are placed on the instrument board. The throttle is placed between the occupants and easily accessible to both. The instrument board carries a banking indicator, turn indicator, air speed meter, altimeter, tachometer, oil pressure gauge, oil temperature gauge, compass and air distance recorder.

The layout of the cockpit and instruments are such as to make a perfect dual control arrangement, but with more facility for engine control, giving to the pilot a valuable point in instruction flying. Access to the cockpit is particularly easy from the running board.

Two complete double ignition systems are provided with double batteries, so that either battery can be used on either system.

From this description it can be readily seen that the designer of the plane has carried out in a practical and thorough fashion a conception of a machine which should serve an extremely useful purpose which is scarcely met by any other machine on the market. A very low power is employed with correspondingly low gasoline consumption, yet with modern methods of aerodynamics and structural design a better performance and more reserve power is provided than in two-seater ships carrying a 100 h.p. engine. The side by side arrangement makes this machine ideal for instructional purposes or for taking up passengers on purely pleasure trips. At the same time the speed and endurance of the machine is such that it can be used for cross-country work and similar purposes. Its sturdy construction also permits its use for rough and ready jazz flying. The small over-all dimensions and simplicity of assembly and disassembly, the absence of the water system in the air-cooled motor should enable the private user to maintain the ship with the least possible trouble and expense for storage, upkeep and repair, as well as for gasoline.

ALUMINUM PISTONS*

By FRANK JARDINE and FERDINAND JEHLE

IT is not the object of this paper to direct attention to the fact that aluminum pistons, due to their lightness, will reduce the inertia forces, thereby decreasing the engine vibration to a minimum and the bearing pressures to a reasonable amount; nor shall we point out that aluminum has a higher thermal conductivity and therefore reduces carbon deposits both above and below the piston head and permits higher compression pressures. These are advantages of aluminum pistons with which all engineers are familiar. We shall only try to point out the developments of aluminum pistons during the last year or so and to make suggestions for their design. This is, possibly, the age of piston invention and it may not be out of place to quote from Professor Diederich's translation of Güldner's Design and Construction of Internal-Combustion Engines, "Less invention more rational design." The internal-combustion engine has possibly both benefited and suffered more at the hands of inventors than any other mechanism, and the piston has received a considerable amount of the energy expended in these directions.

Whenever possible it is well to base a design on something that is known to have worked well before. It is not our intention to suggest that the engineering fraternity attach the same value to precedent as the legal profession but it is well to follow closely along the design of something which we know has worked well. The aviation engine owes its success, in a large measure, to the aluminum piston. It would therefore be wise in designing an aluminum piston for automobile engines to follow somewhat along the general lines of aviation engine practice, taking into consideration the difference in the characteristics of the two engines. It is interesting to follow through the history of aluminum piston design. The first ones were copies of cast-iron pistons which may not have been based on any particular theory. To gain the maximum advantage from lightness, aluminum pistons were at first made very, very thin, and then many ribs were added in the head to make them strong enough. About this time the Liberty engine piston was designed which eliminated ribs and utilized much heavier sections than had heretofore ever been used in any piston.

The Duties of a Piston

Before discussing the design further let us consider briefly the duties which the piston is called upon to perform. It plays one of the most important parts in transferring a certain percentage of the heat energy in the fuel into mechanical energy and it must also assist to a certain extent in providing a path for some of the waste heat. In the exercise of its first function it is necessary that it reciprocate and to do this with the least amount of disturbance it must be light. Furthermore, the gas-engine piston is called upon to do the work which in the steam engine is assigned to three separate parts. It must act as a gas tight plunger and as the piston rod, and it must also work as the crosshead.

In performing the function of plunger it must first of all be gas tight, that is not porous, and must also be of a material which will furnish a good seat for the rings. To perform the duties of a piston rod and a crosshead satisfactorily, it must fit the cylinder with a minimum amount of clearance so that there is very little play when the engine is cold, but with enough clearance so as not to be tight when the engine is hot. In the performance of its second duty, that of providing a path for heat, it is necessary for the piston to be made of a material which is a good thermal conductor. We know that heat enters the piston-head and that a large percentage of this must in time find its way into the water-jacket or cooling fins.

The most important function which the piston performs is that of converting heat into mechanical energy. Providing a path for some of the waste heat is a secondary duty or what we might term "a necessary evil." It is therefore of the utmost importance that the performance of this secondary duty interferes little or none with the performance of the first. Unfortunately up to the present time there has been interference. The heat passing through the piston may cause many undesirable effects such as self-ignition of the charge and excessive expansion of the skirt which necessitates a large clearance when the piston is cold. The first trouble, self-ignition due to a hot piston-head, is eliminated almost entirely by substituting aluminum for cast iron as the piston material. The second, that of clearance, is aggravated by substituting aluminum for cast iron, due to the greater expansion of aluminum.

It has long been recognized that pistons, whether they be made of cast iron or aluminum, must be kept as cool as possible. There has been no agreement among engineers, however, as to how this could best be accomplished. It was thought that if the inside of the piston, particularly the head, were provided with a great number of ribs, much of the heat would be radiated into the inside of the engine and to some degree at least the piston would be cooled by the oil splash. It does not seem reasonable to expect that any great amount of heat can be carried off in this manner. Prof. F. C. Lea, in a paper entitled Aluminum Alloys for Aeroplane Engines which was read before the Royal Aeronautical Society, states:

> It is generally claimed that ribs assist in the cooling of the piston by transmitting heat to the air in the crankcase. The heat-balance sheet of an engine, however, shows that the total amount of heat carried away to the crankcase is comparatively small, and therefore, if the ribs are effective from the point of view of conducting heat from the crown to the skirt they are not effective in conveying heat from the crown to the air in the crankcase. Ribs may be required to strengthen the crown of the piston, especially in those of a greater diameter than 4 in., but it is very doubtful whether a large number of ribs such as are used in the Hispano piston, are of any value; one must, however, have an open mind upon this

* Paper presented before Buffalo Section S. A. E.

question; ribs certainly add to the difficulty of casting. The original sand cast pistons of the Sunbeam Arab engine had six ribs; by maknig four ribs instead of six, it was found possible to cast these pistons easily in the die, and running tests showed that the four-rib piston had no disadvantages as compared with the six-rib.

Tests which we have made on ribbed pistons and pistons without ribs on a Hall-Scott engine seem to confirm the same results. In these tests a careful record of the temperature of the oil and one of the main bearings was kept. Needless to say the quantity of oil in the crankcase was always kept constant. No difference in the temperature of either the oil or the bearing was detected, which could be attributed to the piston design; although a difference in the temperature of the bearing and the oil could be brought about by a change in the atmospheric temperature.

Designs of Pistons

Col. E. J. Hall made the first piston design which came to our attention that had for its object the direction of the heat flow and provision of a good path from the head of the piston to the water-jacket. Fig. 1 is a diagrammatic sketch showing his general theory. The center of the head *a* must be thick enough to insure against the piston getting too hot at this point. Experiments which Colonel Hall made showed that this thickness should be 7 per cent of the piston diameter. It is evident that the piston-head thickness must increase from the center to the wall in order to keep the temperature gradient at the minimum. A certain amount of heat enters between *a* and *b*, which amount must be conducted through the area *b-b*. Let us assume for the sake of argument that none of this heat is lost by radiation, then the section *c-c* must conduct all of the heat which the section *b-b* transmitted, plus the heat which entered the piston-head from the area included between *b* and *c*. Each section farther removed from the center of the head of the piston must increase somewhat from the previous section. The scheme then was to provide sufficient metal behind the rings so that the great majority of the heat would be conducted thorugh this path into the skirt of the piston and thence to the cylinder rather than through the rings to the cylinder wall. His experiments showed that the annular area of the section behind the rings *d-d* should be equal to one-quarter of the total head area. The section *e-e* which is below the rings should have the same area. In the skirt we meet the opposite condition from that in the head for each consecutive section must conduct less heat. Since some heat is transferred into the water-jacket from *e-f* the section *f-f* should have less area than the section *e-e*. By the same reasoning the section *g-g* need not have as great an area as the section *f-f*. When we get to the end of the piston at *h* all of the heat has been lost to the jacket, and therefore, *h* need have no area and consequently no thickness. Naturally it cannot be made without thickness for mechanical reasons such as strength in operation and for handling in the shop and foundry. The best thing we can do it to make *h* as thin as practicable. A piston of this general design was used in the Liberty engine and, as is well known, operated in a satisfactory manner. At this point it may be well to quote again from Professor Lea's paper:

> For pistons up to a 4-in. diameter a ribless piston with a domelike crown thickened toward the skirt and with a good fillet where the crown and skirt join is all that is required, and even for larger diameters it seems more than probable that such a construction would prove satisfactory. Experiments at the Royal Aircraft Factory have shown that such a piston runs cooler than one of the same weight with ribs.

Various attempts have been made to apply Colonel Hall's aviation piston to automobile engines with the result that while it worked very well from the thermal standpoint it was too heavy. It must be borne in mind that Colonel Hall's work was all done with pistons of about the same size, 15 in. or over, and with aviation engines. Aviation engines produce much more power per cubic inch of displacement and consequently more per square inch of piston-head area than automobile engines. The amount of heat entering the/piston-head of an engine is not a function of its diameter but of the square of its diameter. The latter consideration makes it at once apparent that any formula for the head thickness of pistons varying over a great range of sizes cannot be based upon the diameter but must be based on the diameter squared. The total heat developed in the engine must next be taken into considration; that is, we must take due account of the fact that the automobile engine produces less power per cubic inch of displacement and square inch of piston-head area than the aviation engine.

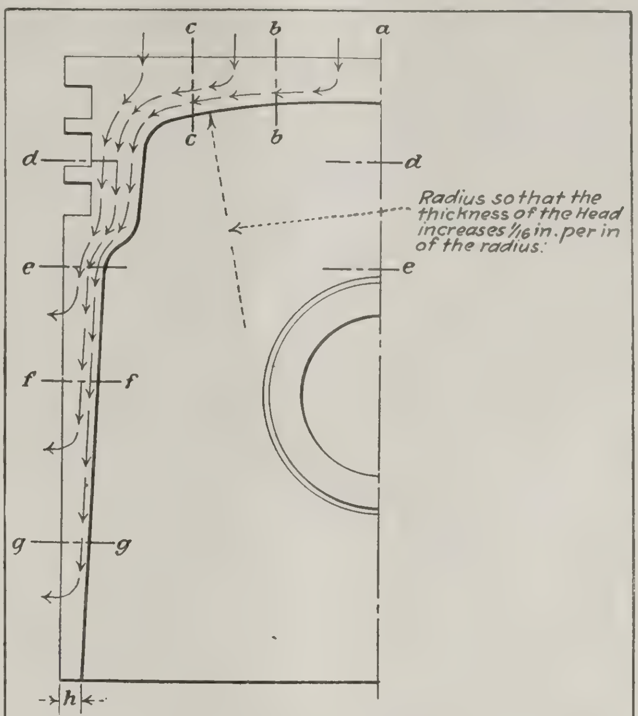


FIG. 1—DIAGRAMMATIC SKETCH OF A PISTON IN WHICH A GOOD PATH IS PROVIDED FOR THE HEAT TO FLOW FROM THE HEAD OF THE PISTON TO THE WATER-JACKET

We shall now try to write a new formula taking these things into consideration. Starting with the Liberty engine operating at 1,600 r.p.m. and developing 400 h.p., we find that the horsepower per square inch of piston-head area is 400/(19.63 x 12) or 1.7. Letting the head thickness vary with the area of the piston-head andthe horsepower developed per square inch of piston-head area, we can write the following formula:

$$T = C_t D^2 H$$

where

T = Head thickness in inches
D = Piston diameter in inches
H = Horsepower per square inch piston-head area
C_t = A constant

In the Liberty piston $T = 0.375$ and $D = 5.0$
Substituting these values in the formula

$$C_t = T/D^2H$$

we get

$$C_t = 0.0088$$

The wall area will also be a function of the heat entering the piston head. We may express this as follows:

$$A_w = C_w D^2 H$$

where

A_w = Wall area in square inches
D = Piston diameter in inches
H = Horsepower per square inch of piston-head area
C_w = A constant

Substituting the values for the Liberty piston of $A_w = 4.91$, $D = 5.00$ and $H = 1.70$ in the formula

$$C_w = A_w D^2 H$$

we get

$$C_w = 0.115$$

In using these formulas the maximum horsepower output of the engine should be used to determine H. It must also be borne in mind that the minimum thickness of the head or the wall depends on foundry practice and will vary for individual cases. It is therefore best to consult with the foundry on this subject.

(To be concluded)

The DH-18 Limousine

Briefly, the DH-18 is a vertical biplane, of the tractor type, with the passengers accommodated in an enclosed cabin approximately level with the wings, and the pilot seated well aft, about half-way between the nose and tail of the body. The engine is mounted in the nose, rather higher than is usual practice, giving a high center of thrust, and, incidentally, ample ground clearance. As the accompanying illustrations will show, the machine is of very clean design, and the performance, as indicated by the figures at the end of these notes, is uncommonly good, the maximum speed being as high as 128 m.p.h., and the cruising speed in the neighborhood of 100 m.p.h.

The Fuselage

As regards the rear portion of the fuselarge, standard De Havilland construction is employed, *i. e.,* the body is a girder structure in which the struts are secured to the *longerons* by sockets having bolts passing through the *longerons,* the vertical and transverse struts being slightly staggered in relation to one another so as to allow clearance for the bolts. Wire bracing of the usual type is employed. The walls of the cabin are of slightly modified construction, three-ply wood being used as a covering material in such a manner that the cabin is watertight when the door is locked. This should ensure that, in case of a forced descent on the sea, the machine will remain afloat for a considerable period, at any rate sufficiently long to give a very good opportunity of saving the occupants. In order to increase further the chances of remaining afloat, a large air bag is fitted in the rear portion of the body, aft of the pilot's seat.

The Passenger Accommodation

The cabin is very comfortably arranged. Some of the seats face forward, while others face the opposite way. The general scheme of the cabin will, however, be practically unaltered. The passengers, of whom eight can be accommodated, gain access to the cabin through a door in the port side, and windows are provided in both walls, so that, apart from the obstruction offered by the lower main plane, the view obtained is quite good. In addition to the side windows, skylights are provided over front and rear portion of the cabin. These skylights, incidentally, form part of the curved roof of the fuselage, and under each, cut in the flat ceiling of the cabin, is a circular opening through which, and through the skylights, the passengers could, if necessary, effect their escape should the side door be out of order, after a bad landing, for instance. The value of these emergency exits as a means of escape in case of necessity should be especially appreciated by nervous passengers, and such exits ought, in fact, to be compulsory on all passenger aircraft. Aft of the cabin, and more or less underneath the pilot's cockpit, is a space for luggage, of which a fair amount can be carried.

Another feature of this design, in which Captain de Havilland has shown that he appreciates the need for designing for commercial conditions, is the manner in which the engine and its mounting and housing are arranged to be detached as a complete and separate unit. One of the accompanying sketches shows the engine bearers and their supports, while underneath is indicated the way in which the engine unit is attached to the main *fuselage.* By simply undoing four bolts, one at each corner, and disconnecting the petrol pipes, etc., the engine engine unit can be removed for overhaul in the shops, and another unit substituted, so that the machine need not be idle while its engine is being overhauled. This advantage of unit construction is one to which we have drawn attention repeatedly, and it might with advantage be extended to include other parts of machines.

The radiator is mounted below the engine, and is rigidly fixed, the amount of cooling being regulated by slats as indicated in the sketch. The main petrol tanks, carrying slightly over 100 gallons, are mounted in the deck fairing above the cabin. The service tank is in the top center section. (*Flight,* March 24, 1921.)

The Van Berkel Seaplane

The Van Berkel W.B. follows closely the lines of thefamous Brandenburg monoplanes which were at one time a pest in the North Sea. The flat-sided fuselage is very deep at the stern, and takes apparently the place of the usual vertical fin, of which none is fitted in front of the balanced rudder. The latter differs from that of the Brandenburg machine in that it extends and has a balance above as well as below the fuselage. Otherwise it is a matter of some difficulty to discover any difference between the two machines. Without knowing the detail construction it is impossible to state whether this similarity is superficial only, or whether it extends to details.

The wing is of the semi-cantilever type, of fairly thick section and braced by a single pair of struts on each side. The bracing gives the impression of being very rigid, and it is a question whether, everything considered, this semi-cantilever arrangement is not to be preferred to the true cantilever wing. Certainly it should come out considerably lighter, and the resistance on the streamline tubes cannot amount to a great deal. A point which impresses one with regard to the wing is that the dihedral angle is very small for such a high c.g. Thus the Junkers monoplanes have been found to be very tricky laterally when near the stalling angle, in spite of the very pronounced dihedral angle of the wing. In the present machine the wing is not tapered towards the tip, and possibly this fact may explain the reason for the small dihedral.

The two floats are built of aluminium alloy, as it has been found that the ordinary wood floats do not stand the climatic conditions in the Dutch colonies very well. They are of the three-stepped type, and terminate in a vertical stern post while the nose is rounded. The machine is said to get off well in spite of its heavy loading, and its speed when once in the air is quite good.

The engine fitted is a Rolls-Royce Eagle VIII commercial type, and drives a tractor airscrew. Cooling is provided by two Lamblin "lobster pot" radiators placed underneath the fuselage between the struts of the undercarriage. In view of the use for which the machine is intended, the radiators are of large size so as to ensure adequate cooling in the hot climate of the Dutch East Indian Islands. The armament consists of three machine guns, two of which are fixed and fire forward, the third being operated by the gunner, and of a nest of bombs. The petrol tanks have a capacity of 172 gallons, which gives a duration of about 7½ hours at full throttle. At cruising speed the range is approximately 1,000 miles. The maximum speed at low altitudes has been officially measured as 180.2 kms. per hour (112 m.p.h.), which is rather good for a seaplane of this power and loading. The total useful load amounts to 2,100 lbs., of which approximately 1,350 lbs. is taken up by the petrol. As a long-distance reconnaissance machine, the W.B. should prove quite useful in the colonies.

Its main dimensions are: Span, 64 ft.; length, overall, 36 ft.; height, 14 ft.—*Flight,* April 14, 1921.

Novel Design of Seaplane

The design suggested is a combination of the flying boat and float type of seaplane, being characterized by great seaworthiness. It is a three-engined monoplane, the engines being placed in line in the centre of the main plane. Each engine drives its own propeller, there being three in line, successively a tractor, pusher and tractor. The wing is cut away round the engines and slopes downwards toward the hull of the boat.

Floats are placed on either side of the hull to improve the seaworthiness. The floats are intended to carry landing wheels so that the boat would be of the amphibian type. The distance between the wheels being considerable, landing on the ground is much easier than with some amphibians. (*Het Vliegveld,* Dec. 18, 1920. 7 cols., 3 diags., 3 photographs.)

Small Racing Aeroplanes

Below are given the characteristics of the three aeroplanes entered in the Luigi Mapelli Cup, of which the results have been given:

	Breda.	Macchi.	Ricci.
Span	4 m.	6 m.	3 m. 45
Length	4 m. 50	4 m. 52	3 m. 80
Height	2 m. 90	2 m. 80	2 m. 28
Wing area		12 m ^{2}.	11 m ^{2}.
Motor	Anzani	Anzani	Anzani
Power, H.P	45	30	45
No. of Cylinders	6	3	6
Bore	90	105	90
Stroke	120	120	120
Airscrew	Breda	Macchi	Ricci
Do., dia.	1 m. 92	1 m. 90	1 m. 95
Weight empty (kg.)	180		150
Weight total (kg.)	215	200, 5	210
Get off	50 m.	50 m.	56 m. 42
Do.	8 2/5 sec.	9 1/5 sec.	6 sec.
Land in	46 m., 20	57 m.	63 m., 70
Radius of action	2 h.	3 h.	3 h.
Speed (kmh)	116	126	128
Height attained	2,500 m.	3,770 m.	1,500 m.

(*L'Aeronautique,* Feb., 1921. ¾ col., 1 illustration.)

NAVAL and MILITARY AERONAUTICS

Inspections by Seaplane

Secretary Denby authorizes the following:

According to a report just received by Captain W. A. Moffett, Director of Naval Aviation, the Commandant of the Naval District including the Hawaiian Islands, is no wmaking inspections by seaplane. Recently the Commandant, Admiral W. R. Shoemaker, took passage on an HS-2L flying boat from Pearl Harbor and visited the Islands of Maui and Hawaii. The first leg of the flight from Pearl Harbor to Maui was made without incident and the trip from Maui to Hilo, Hawaii, was made in record time. On the return flight from Hawaii to Pearl Harbor Admiral Shoemaker's plane and another which accompanied it were caught in a strong wind. Despite this, however, the distance of 236 miles was made in two hours and 30 minutes

Another feature of the trip was the fact that constant radio communication was maintained with the planes, enabling the Admiral to carry on routine duty just the same as though he had been in his office at Pearl Harbor.

It is believed that the perfection of radio equipment on seaplanes is now such that inspections of this character will be more and more engaged in by District Commandants and other high-ranking officers in the Navy whose command extends over large territories.

A New Activity Centered at McCook Field

Lt. R. E. Thompson of the Balloon and Airship Experimental Station at Fort Omaha, Nebraska, arrived at McCook Field, Dayton, Ohio, last week in order to make preparatory plans for the removal of the station from Fort Omaha to Dayton. The remaining personnel of the organization, consisting of Captain Allen P. McFarland and thirty-four civilians, will follow as soon as plans are completed to effect the removal.

The consolidation of the Balloon and Airship Experimental Station with the Engineering Division, Air Service, will place the engineering of lighter-than-air craft development under the direction of Major Bane.

Army Forest Patrol

Major Arnold's visit to March Field concerns establishment of forest fire patrol operations from this base. He stated that although the Ninth Aero Squadron had been detailed to carry out all patrols in this corps area personnel from this school will be selected to patrol the Los Angeles and Cleveland reserves, between March Field and Santa Barbara, and March Field and San Diego, as was carried out from this base last season.

Other than patrols operated from Mather Field, Sacramento, field bases will be established at Walla Walla, Wash.; Eugene, Oregon; Red Bluff and Fresno, California.

Colonel Lawton and Major Arnold will proceed to Rockwell Field, San Diego, and Ross Field, Arcadia, before returning to Corps Area Headquarters in San Francisco.

When to Use a Parachute

Under date of April 10 an article on parachutes appeared in the Chicago *Tribune* in which this statement was made: "30 per cent of the aviators who have met death in crashes had an opportunity to jump free from their planes, and would not have been killed had they worn parachutes."

With regard to this, Major Follett Bradley, Assistant Commandant Post Field, Fort Sill, Oklahoma, has written to Major H. M. Hickam, Chief of Information Group, Air Service, as follows:

Your attention is invited to a News Item in the April 10th edition of the Chicago *Tribune,* which states that parachutes might have saved 30% of aviation deaths.

I do not know what the attitude of your office is with respect to these parachutes, but I should like to submit my own personal viewpoint on the matter. This viewpoint is concurred in by the majority, if not all, of the older pilots at this station:

It is our opinion that a pilot who leaves his ship by means of a parachute, except under the following circumstances, is guilty of gross misconduct. By so doing he does not endeavor to save an extremely valuable piece of government property. We think that if pilots are required to wear parachutes, and are encouraged to use them, it will lead to many crashes that could have been perfectly safe landings, and will encourage faint-heartedness. The occasions upon which we think it justifiable to use a parachute are practically all covered by the following:

(a) Fire.

(b) Collapse of the plane, or of some essential portion of it, such as loss of a wing, loss of a control surface, breaking of a control wire.

(c) Collision.

Report of Changes of Stations of Officers for Week Ending April 26

April 19, 1921—First Lieutenant Bernard S. Thompson ordered from Post Field, Ft. Sill, Oklahoma, to Langley Field, Hampton, Virginia, for duty as instructor in Communications.

April 19, 1921—Order previously issued sending Major Henry B. Clagett to School of the Line, Ft. Leavenworth, Kansas, revoked.

April 19, 1921—Major Leonard H. Drennan relieved as Air Officer, 1st Corps Area, Boston, Massachusetts, effective September 5, 1921, and ordered to Ft. Leavenworth, Kansas, for duty as student officer at the School of the Line.

April 20, 1921—Following Air Service officers ordered from March Field, Riverside, California, to Post Field, Ft. Sill, Oklahoma, for course at Observation School: Major John H. C. Williams, 1st Lt. Francis W. Ruggels, 1st Lt. Samuel P. Walker.

April 20, 1921—First Leutenant Walter R. Peck, Inf., detailed to Air Service, relieved from duty in Hawaiian Department and ordered to Carlstrom Field, Arcadia, Fla., for pilot training on August 1, 1921.

April 22, 1921—Following officers ordered from March Field, Riverside, California, to Kelly Field, San Antonio, Texas, for bombing training: Captain Early E. W. Duncan, Captain Wolcott P. Hayes.

April 23, 1921—Following officers ordered from March Field, Riverside, California, to Post Field, Ft. Sill, Oklahoma, for course at Observation School: Major Jacob H. Rudolph, 1st Lt. Carl F. Greene, 1st Lt. John McRae, 1st Lt. Samuel C. Skemp, 1st Lt. Russell L. Williamson.

April 23, 1921—Major Edwin B. Lyon, Air Service, ordered upon completion of duties at West Point, New York, to Boston, Massachusetts, for duty as Air Officer, 1st Corps Area.

April 23, 1921—Following Air Service officers ordered from stations indicated to Langley Field, Hampton, Virginia, for course at Airship School: 1st Lt. Robert S. Olmstead, 1st Lt. Harvey H. Holland, 1st Lt. Arthur Thomas.

April 25, 1921—First Lieutenant Charles E. Branshaw ordered from Gerstner Field, Lake Charles, Louisiana, to San Antonio, Air Intermediate Depot, San Antonio, Texas.

April 25, 1921—Following officers ordered from stations indicated to Ross Field, Arcadia, California, for lighter-than-air training: 1st Lt. Frank Kehoe, Brooks Field, San Antonio, Tex., 1st Lt. George G. Cressey, Langley Field, Hampton, Va.

April 25, 1921—Following Air Service officers ordered from Langley Field, Hampton, Virginia, to Post Field, Ft. Sill, Oklahoma, for duty at the Observation School: 1st Lt. Roscoe C. Wriston, 1st Lt. Donald G. Stitt.

April 25, 1921—Lieutenant Clifford E. Smythe ordered from Ross Field, Arcadia, California, to Langley Field, Hampton, Virginia, for duty.

San Francisco Aero Association Formed

The San Francisco Aero Association was recently organized, with Guy T. Slaughter as Treasurer, H. G. MacEachen as Secretary, and James Otis as President. The association will stage its first meet at the Marnia on May 15, and Major H. H. Arnold, Western Air Officer, will cooperate in making the event a success.

Aerial Propagandists

Runser and Turner, to whose work we have referred from time to time in AERIAL AGE, are now located in Columbia, S. C., where they are continuing to effectively educate public opinion in the possibilities of aeronautics.

The local celebrities have all made trips in the Avro and the Columbia Press has been particularly cordial in their reception of the aviators.

Recently Lieut. Runser addressed the local Chamber of Commerce and as a result of his talk substantial interest has been created amongst the membership of this body.

FOREIGN NEWS

Bellanger Works Build Monoplane

It is reported that the automobile firm of Bellanger have just completed the designs for a new large amphibian machine. Designed by M. Richard, the monoplane will have a span of 21 metres, and will be driven by three engines of a total power of 1,500 h.p. It is to carry 30 passengers, and will be able to alight on either land or sea.

Poulet on the Wing Again

After a stay of several months Poulet and his mechanic, Benoit, and a passenger have left Java on their Caudron biplane and have arrived at Celebes, where they have landed at Kakaskassen, on an aerodrome situated about 2,500 ft. above sea level. The aerial travelers were fêted by the European populace.

The Nimfuhr Syndicate

A German journal, quoting the Austrian Press, gives the following information, which is said to have been furnished by Dr. Nimfuhr himself:—

On June 7, 1920, the Dutch "Nimfuhrsche Syndikat" was founded in Holland with the co-operation of financiers and experts, including Herr Schwengler, chief engineer at the Zeppelin Works, and Herr Skopik, head designer at the Fokker Works, and with Dr. Raimund Nimfuhr as president. The syndicate entered into negotiations with a French financial group, which desired to take over the patent rights for exploiting the "soaring aircraft" in France and Japan. The negotiations proceeded favorably, and at the end of June a contract was finally drawn up, in which the French concern acquired Dr. Nimfuhr's patent right for France at a price of 750,000 Dutch florins and a percentage of the profits.

At the same time the French concern paid down a third of the purchase price, viz., 250,000 Dutch florins (6,250,000 German-Austrian kr.) for the option of these patent rights, and were promised the Japanese patent rights after fulfilling the rest of the conditions. This option ran out on October 7, 1920, and on the same day the payment of the other two-third of the sum fell due (500,000 Dutch florins), which was not paid up by the French concern in spite of a month's extension.

In the meanwhile, an American financial group entered into negotiations with Dr. Nimfuhr's Vienna office for the acquisition of the American and Japanese patent rights. The French, hearing of this, tried to stop these negotiations with the Americans. Repeated attempts to come to an agreement with the French having failed, the negotiations were continued with the Americans, and a speedy settlement is hoped for. On the invitation of the American company, Dr. Nimfuhr, with his assistant, Engineer Gazda will shortly go to America to complete these negotiations and to start the construction of soaring machines on a large scale. After his return, Dr. Nimfuhr, who is an Austrian, hopes to set on foot a scheme for the mass construction of his machines in Austria.

Increase in Italian Aviation Budget

The Minister of War has been successful, it is stated, in obtaining a substantial increase to the 17 million lire already voted for aeronautical purposes, amounting to about 30 million lire. The firms still engaged in the production of aircraft are to receive 1 million lire each for delivery of machines and as a subsidy towards research and experiments. These firms are Ansaldo, Fiat, Savoia, Macchi and Breda. It is stated that the Fiat firm will complete their giant three-engined machine for sixteen passengers and that they are to deliver two A.R.F. machines.

A Berlin-Moscow Air Mail?

The Lithuanian Government, it is reported, has informed the Russian Soviet Government that the preliminary steps have been taken to run regular mail services between Berlin, Kovno, Riga and Moscow.

Aleppo-Alexandretta Air Service

This air-mail service, to which reference was made some little time ago in AERIAL AGE, is now operating regularly three times a week, and transports both civil and military mail. Special "air-mail" stamps have been issued. It will be remembered that it is this service which, taking about one hour per journey, displaces the previous rail and steamer route occupying eight to ten days! A similar service is now proposed between Hama and Latakia.

Opening Up Belgian Congo by Air

In a recent lecture respecting aviation prospects in the Belgian Congo before La Société Belge des Ingenieurs et des Industriels, Colonel Van Crombrugge, Director of Aeronautics at the Ministry of National Defence, stated, in connection with the Kinshasa-Stanleyville air line, that the Forminiére Company, which exploits diamond mines at Djoko-Punda in the Province of Kasia, has requested the institution of a service between Kinshasa and the mines. The journey is one of 800 kilometres and the distance can be covered in two days by aeroplanes, whereas 35 to 40 days are at present required for the journey by boat. A route is being studied and will be decided upon almost immediately the company having offered to defray the greater part of the initial costs.

Colonel Van Crombrugge also said that it had been decided to survey and chart the river Congo by means of aerial photography and that it is hoped to complete this work in 2 or 3 years instead of the 10 to 15 years which would have been required if the present methods had been maintained.

Aero Club of France President and Officers

For the ensuing year, the Aero Club of France have re-elected M. André Michelin to the President's chair, the Vice-Presidents being Count de la Vaulx, Rodolphe Soreau and in the place of M. Jacques Balsan, M. Tissandier. M. Georges Besancon remains Sec.-General, M. Pierre Gasmer du Fresne, Treasurer, and the Members of the Council are MM. Blériot, Col. Ferrus, Alfred Leblanc, Paul Rousseau and Surcouf.

Switzerland Acquiring War-'Planes

Sixteen Italian-constructed Hanriot-Nieuport planes have been acquired by Switzerland, and in addition they have bought ten Fokkers which were allotted to Belgium under the Peace treaty rights and declined by the latter.

4,000 Miles Aeroplane Flight

Handley Page Transport, Ltd., announce some interesting particulars of the recent flight of one of their aeroplanes from London to Athens and back. The total flying time from London to Athens was twenty-one hours thirty-five minutes, and on the return journey nineteen hours five minutes. The total distance flown was about 4,000 miles.

The following is the exact time-table, all the flights between the places named being non-stop on both journeys:

Cricklewood to Paris, 2 hr. 30 min.; Paris to Lyons, 2 hr. 50 min.; Lyons to Nice, 2 hr. 30 min.; Nice to Rome, 4 hr. 15 min.; Rome to Brindisi, 4 hr.; Brindisi to Agrennon, 4 hr. 15 min.; Agrennon to Athens, 1 hr. 15 min. Return journey—Athens to Brindisi, 3 hr. 30 min.; Brindisi to Foggia, 1 hr. 30 min.; Foggia to Rome, 2 hr.; Rome to Nice, 4 hr.; Nice to Lyons, 2 hr. 35 min.; Lyons to Paris, 2 hr. 50 min.; Paris to Cricklewood, 2 hr. 40 min.

Italian Aviation Activities

The Cooperative Nazionale Aeronauti (National Aeronautical Cooperative Association), recently acquired about forty machines—S.V.A., Ballila, Hanriot, Fokker monoplanes, and dual control Aviatiks. Propaganda and advertising flights have been commenced, and a Rome to Naples service is under consideration.

The Italian National Aeronautical Co-operative Association was founded in October, 1920. It includes in its membership the "Associazione Lavoratori Aeronauti" (Association of Aeronautical Workmen), and the "Associazione Piloti Aeronauti" (Association of Aeronautical Pilots). One of its objects is the "organization and operation of services of public utility." It is reported to have the support, financially, of a group of banks.

Proposed New Semi-Rigid for Italy?

According to the Italian Press, the funds arising from the sale of the "Roma" are to be used for the construction of a new semi-rigid airship, which is to be commenced shortly.

Bayonne-Bilbao-Santander Air Service

The air mail and passenger service which has been running regularly since August last between Bayonne and Bilbao was extended on March 1st to cover the section Bilbao-Santander.

Constantinople Air Port

A French Presidential decree issued last month provided for the French military air personnel and material at the Constantinople aerodrome (San Stefano), to be placed by the Ministry of War at the service of the Ministry of Public Works for employment in civil aviation.

651,000 Kroner for Civil Aviation

The Swedish Government has applied for a grant of 170,000 kroner for civil aviation for 1921 and 360,000 kroner for 1922. In addition, in order to improve the State Meteorological Service, a grant of 60,200 kroner for 1921 and 60,800 kroner for 1922 is requested.

Mapping the Orinoco Delta

Some accounts of an aerial survey to be carried out in Venezuela have already appeared. We are now able to give a fuller account of the enterprise, which is of special interest at a time when pessimists seem inclined to question the commercial utility of aircraft.

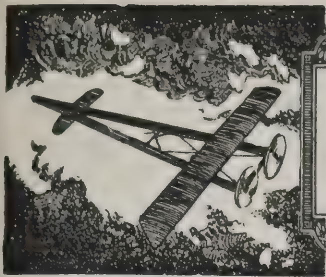
The British controlled Oilfields, Ltd., have obtained from the Venezuelan Government concessions to prospect for oil in the delta of the Orinoco and work it when found. This delta is a huge unchartered triangle, many hundreds of square miles in extent, covered by mangrove swamps and forests, and intersected by innumerable streams. High trees come down to the water's edge, and the roots of the mangroves offer a formidable obstacle to any boat which tries to approach the muddy shore. To survey and map this area by means of boats and landing parties would be an immensely tedious and expensive work. Nor would it offer any certainty of profit, for a party might easily pass quite close to an oil spring in the forest and yet remain in blissful ignorance of its existence. From up above, however, there should be no difficulty in observing the places where oil abounds, for where it rises to the surface of the ground the vegetation withers and dies. The prospecting is, therefore, a task beyond the powers of any of the older methods of survey, and is an obvious function of aircraft.

The oil company in question have not been slow to recognise that fact, and have given a contract for a survey by aerial photography to the Bermuda and West Atlantic Aviation Co., Ltd., whose interest in that part of the world is already well known. This company is especially well qualified to carry out the task, not only on account of its interest in the West Atlantic but also because of its experience in operating marine aircraft. This is essentially work for flying boats. The streams of the delta will provide the aerodrome and the emergency landing places, while the boats when not in use, can ride out at moorings, thus avoiding the necessity of erecting sheds.

Two supermarine flying boats have been dispatched to Venezuela, one fitted with a 160 h.p. Beardmore engine and the other with a Puma. One part of the delta is so similar to every other that considerable care will have to be taken in making the first map. The boats will have to fly accurately along straight lines, and the task of the photographic staff in fitting together the various photographs will not be too simple. This part of the work is in the capable hands of Mr. W. D. Corse, a very expert aerial photographer, who will be backed up by three assistants who have all had much experience of such work in the R.A.F. The camera which will be used is of the L.B. type, and it is understood that the photographic gear alone has cost about £1,300.

The expedition is under the leadership of Major Cochran Patrick, D.S.O., M.C., who is accompanied by two pilots, Messrs. C. E. Ward and F. Bailey, and three highly qualified rigger and fitter assistants. The party will live in two steel barges, which will be moored in one of the main streams of the delta. After the survey work on the Orinoco has been put well in hand, Major Patrick will move on to British Guiana to arrange with the Government there for an aerial survey of that colony. The inhabited coastal strip is separated from the savannahs of the interior by a belt of dense forest, and the rivers which traverse it are rendered unnavigable to anything larger than a canoe by numerous rapids. Development of the colony is impossible until a satisfactory map has been made, and the Government has therefore opened negotiations with the Bermuda and W.A.A. Co.

With these instances before us it would be a rash man who now would assert that aircraft are a mere "luxury form of travel" and of no use to the practical business of the world.



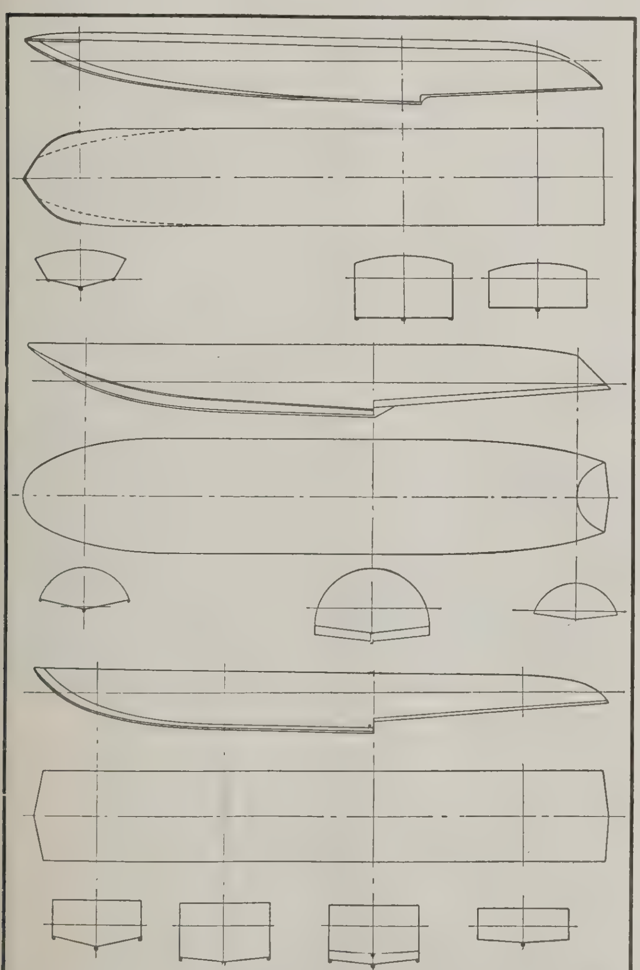
ELEMENTARY AERONAUTICS *and* MODEL NOTES

Model Float Construction

THE dimensions and shape of pontoons are determined by the work required of them; for example, when the weight of the model is distributed on three floats, they may each be relatively small and of short length, but when a single or double float system is used, long floats are required to insure the necessary longitudinal or fore-and-aft stability when afloat. The flying boat type requires a long boat body, which eliminates the tail-float necessary on hydroaeroplanes. When the question of the float system has been decided upon, the problem of sizes becomes easy of solution.

It is essential that the weight of the model be known or closely estimated before pontoons of good proportions can be designed. First assume that the floats are to have 200% reserve buoyancy, then each float must have a buoyancy which will be three times that required to keep the top of the float above water. For example; if the model weighs five ounces, and the float (or floats) will carry a weight of fifteen ounces before becoming totally submerged, the reserve buoyancy is twice as great as that required for flotation. Where three floats are used, each float could be made to carry one-third of the load; more than three floats are seldom used.

When calculating the size of pontoons it must be considered that in alighting on the water after flight the impact may submerge the floats and overturn the model. Also, a model often alights or takes off unevenly, and at times most of the weight comes upon one of the floats, which would surely sink if not possessing three or four times the buoyancy required to keep the model afloat when at rest. Good judgment is necessary to proportion the float sizes so as to be as small as conditions will allow.



Three good designs for hydroaeroplane pontoons. The waterline is indicated in the side views and at each of the cross-sections

Floats or pontoons will sustain a weight equal to the water which they displace. A float 1 inch square will displace 1 cubic inch of water. As it is an easy matter to weigh the water thus displaced, the proper cubic dimensions of the float can be readily determined. A cubic inch of fresh water weighs about .576 oz. This weight is slightly variable according to the density of the water; sea water is heavier and pontoons have more buoyancy in it. The value of a float's buoyant qualities is in direct proportion to its lightness as compared to the weight of the water it displaces, and its first measure of efficiency requires that a light structure be employed. The lighter the float, the more quickly it reaches the surface of the water when taking off, and consequently the resistance against the water occupies a shorter time.

As water resistance is considerable as compared to the resistance of the air, floats should be designed to get off the water just as quickly as possible. At first glance it might seem that this would be merely a matter of tilting the front of the floats upward so they will come to the surface sooner but such a theory has some serious drawbacks. Of course by loading a model with a great quantity of rubber motive power, nearly any hydro can be made to leap out of the water and perhaps even fly for a short distance, but the results of such a practice are not comparable to the graceful skimming on the surface and long even flights of well designed water models.

Careful observation on the part of the builder is necessary to determine the best angle at which to set the floats. For the best efficiency, floats should be designed so that they totally emerge from the water at the same instant that the model reaches its full flying speed. If floats are arranged to come above the water too quickly the possibilities are that the model will not have had sufficient time to attain the proper flying speed, and the model will quickly return to the surface of the water; the speed will then be lowered still more when the floats again encounter the resistance of the water.

The effect of "porpoising" or bouncing on the water is usually the result of poor balance. Assuming that the model will fly properly when hand-launched and with floats attached, proper balance on the water is a matter of shifting the pontoons fore and aft so they leave the water in a gradual manner.

(To be continued)

Successful Membership Campaign Conducted by the Pacific Model Aero Club

In connection with the campaign being conducted for membership by the Pacific Model Aero Club, some novel leaflets have been distributed with very good response. The leaflet contains a very lively illustration showing two youthful aeronauts in heated discussion, one occupying a craft which is obviously intended to be an airship, while the other, seated in a monoplane, seems uncertain of his perch and steadies himself with one hand while he waves the other wildly at his opponent. Accompanying the illustration is the following legend:

"MODEL AIRPLANE BUGS!

Anyone interested in model airplanes please communicate with the Pacific Model Aero Club, 240 Eleventh Avenue, San Francisco. If you are able to construct successful models you are eligible to membership.

HUBERT A. BURGESS, President."

That the Club is of the progressive type is shown by the great number of contests which have been held so far this spring, which is a fine indication of the enthusiasm with which the sport has been received by our western cousins.

The Pacific Model Aero Club assists in building up our Aero Mail Service by marking on the envelopes of letters "Send by Aeroplane"; this practice might well be followed by others whose interest lies in the promotion of our Aeroplane Mail Service.

More Memories

(An answer to the poem "Reminiscences," which appeared in *Aeronitis* the week of March 7, 1921.)

Yes, I remember those evening offensives,
For on many of them we were slated.
But think back, my lad, on the "Dawn Patrol"
And remember how much it was hated.

Yes, I remember my cheerful "Ach Emma,"
Safe, presumably, from all the harm.
But carelessly, while swinging the prop one day,
Let the blade of it break his arm.

Yes, I remember, but not over Armentiers,
Another small town, Peronne by name;
Just thirty miles back, we patroled it daily.
'Twas here that McDonald gained his fame.

Yes, I remember the peeps at my wrist-watch,
And wondered with much despair;
How it was that the fat old "Rumplers"
Always patrolled in such rarefied air.

Yes, I remember the red-painted "Fokkers."
And I am the possessor of a piece of one,
The pilot of which had blazed the trail
Of more Allied Fliers than any other Hun.

Yes, I remember, too, just as the sun dip't,
How much we loved that western ride,
With the sun in our face and "Archie" behind.
Wren below and Daey off to the side.

Yes, I remember as the darkness descended,
No more work; and hunger to appease,
Then to the "Armstrong" to pound your ear,
Only to be wakened by a twin "Mercedes."

But now that you are at home my lad,
And it is all over and done,
Aren't you damned glad at least
That you took part in the fun?

—Speed.

He Looked at It

The nervous young flying officer sat down at a table in the vegetable restaurant.

"Crushed nut, sir?" asked the waitress, handing him the menu of the day.

"No, no; shell shock," he replied.

STICK CONTROL

Why Aviators Go Mad

Onlooker, pointing to shock absorber cord on axle: "That's the first time I ever noticed the electric windings that drive the wheels; where's the connection that leads to the battery?"

Questions and Answers

Question: Are misplaced eyebrows and pompadour hair requisites to a successful pilot?

Answer: Yes. A full-grown mustache well blown up into the nostrils and the pompadour hair is effective from a streamline standpoint.

An Airplane Inspection

One day I received an invitation,
To see an airplane inspection.
First of all was the S. V. A.
Which is not made in the U. S. A.
It is made far across the sea,
In a country called Italy.
And next the De Haviland 4,
Which has a 7-inch stroke
And a 5-inch bore.
And the Curtis Oriole all painted red
Which will cheat you out of your milk
And bread.
And also there was the Avro,
Which has 3 seats straight in a row.
And last of all was the Curtis canuck,
And to get to ride will cost you ten
Bucks.
And after seeing all of this,
Ignorance I thought was bliss.
And I made up my mind to take a spin
And I choose the old Curtiss J.N.

Robert Edmonson (Aged 16 years).

The Airman in the Moon

(By one afflicted with Aeronitis)

1

Do you know there's an airman in the moon?
Listen, I'll tell you his story.
It was on a starlit night in June
He was lured by the satellite's glory.

2

With adventurous feeling he mounted the sky,
In his night-flying aeroplane;
He lost his balance, he went so high,
And couldn't get righted again.

3

In ethereal realms his plane was tossed,
And gravity lost its hold;
He looked to the man in the moon as a host,
For he was getting dreadfully cold.

4

Just then his airplane bumped into the moon,
He was lured by the rays of light so warm;
He heard a voice humming a queer little tune,
And knew that he could not come to harm.

5

Then he was met by the jolly moon-man
Who was glad to see an earthly mortal,
And whose lovely daughter gave him her hand
When he walked through the majestic portal.

6

No one has heard of that man anymore,
But they say on some nights can be seen
An airplane parked at the old moon's door,
And an airman there, with his queen.

—Agnes M. Chambers.

AERIAL AGE
WEEKLY

OL. 13, No. 11 | May 23, 1921 | 10 CENTS A COPY

Hamilton Harbor, Bermuda, Photographed by the Bermuda & West Atlantic Aviation Co.

Aero Club Warns Congress Against Dumping

ISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
riptions: Domestic, $4; Foreign, $6. Entered as second class matter March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879


For the
BILLIARD ROOM
For the
CLUB
For the
OFFICE
For the
HOME

G. DOUGLAS WARDROP
Editor
B. C. BOULTON
Contributing Technical Editor
G. F. McLAUGHLIN
Contributing Technical Editor
NORMAN E. JENNETT
Art Editor
H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIII NEW YORK, MAY 23, 1921 NO. 11

AERO CLUB WARNS CONGRESS AGAINST DUMPING

THE Aero Club of America and its affiliated organizations in the principal cities of the United States has called the attention of the President and the Secretaries of War and Navy to the arrival in this country of F. Handley Page, head of the British Government Aircraft disposal monopoly, which for the last year has been trying to dump into this country all the surplus aeroplanes and other aeronautical material left over from the war. They also requested the Administration to state whether the defeat of Senator New's amendment to the Emergency Tariff Bill in the United States Senate, providing protection for the American Air Service against the dumping of this foreign material, was in harmony with the Administration's policy of independent preparedness in the air.

The amendment as offered by Senator New provided that the appraisal value of aircraft imported into this country be based on the cost of production rather than on the one per cent of the original cost which the British interest paid their Government for the war material. Senator Boies Penrose defeated the amendment in the Senate, asserting that there was no American aircraft industry to amount to anything, and that the United States should go to England for its aeroplanes if it could get them more cheaply.

Maurice G. Cleary, Directing Governor of the Aero Club of America, said, "Senator Penrose evidently was misinformed. There is an American industry, which has been in a critical state since the British monopoly, as headed by Mr. Handley Page, first tried to dump all its surplus and obsolete military planes into this country a year ago.

"I understand that the chiefs of the Army and Navy Air Services urged the passage of the New amendment on the grounds that the aircraft industry is most necessary to the nation if we are to hope to maintain defenses in the air over land or sea.

"If a foreign nation is permitted to deluge the American aircraft market, the early destruction of the American aircraft industry is inevitable, and this industry constitutes our only source of supply in case of war.

"The menace," said Mr. Cleary, "appeared first a year ago, when the British Government disposed of £100,000,000 worth of surplus aeronautical material which, it was admitted, could not be distributed in the British Empire without killing the British industry. This material was sold to the Aircraft Disposal Company, Ltd., for one per cent of its cost of production, or £1,000,000. It was specifically agreed that the British Government should receive 50 per cent of the net profits from the sales of this obsolete material, which, it was stipulated, should be sold in foreign countries."

Mr. Cleary added that British missions have been attempting to create a market in other countries, but without success because of protective legislation similar to that which Senator Penrose's action last Wednesday defeated in the American Congress.

The telegram from the Aero Club addressed to the President read:

"Request that you advise whether Senator Penrose's opposition to American aircraft industry is in line with Administration policy of national defense in air. Unless Senator New's Amendment to Emergency Tariff Bill is adopted by conferees and passed, the aeronautical industry will be in danger of destruction and America will be placed at the mercy of any foreign power."

Similar telegrams were sent to the Secretaries of Navy and War, and members of Congress.

Silencing Aero Engines

ONE of the great discomforts of travel by air has, up to date, been the noise set up by the engine. It has generally been so great that conversation even in an enclosed cabin has been extremely difficult, if not impossible, and many passengers have suffered temporarily from deafness as a result of their trip. It has not been found practicable to fit silencers of the type used on ordinary motor-car engines on account of the additional weight and loss of power incurred by a fitment of this type. Now a Swiss engineer has apparently solved the problem and brought out an aero muffler which does not heat up or diminish the power of the engine, but reduces the noise sufficiently to allow easy conversation between pilot and passengers. The prinicple of the apparatus is very simple, consisting only of a marked rapid cooling of the exhaust gases, which action is assisted by a short suction by small revolving blades and by centrifugal motion generated in either connection on the camshaft or from very small exterior blades around the movable head of the muffler. The gases enter the tapered rear end of the silencer into sleeves similar to an automobile muffler, and are sucked and thrown out of the spinning head of the front end. This reduces the noise by well over 50 per cent., and at an altitude of 2,000 ft. the noise of the engine can hardly be heard by a person on the ground. As the muffler can be enclosed in a streamlike case placed close to the top or bottom of the motor, the extra head resistance is negligible. Needless to say this invention will greatly add to the comfort of commercial flying and will be of tremendous use in aerial warfare.

The News of the Week

Aero Club Field House Officially Opened

The Field Club of the Aero Club of America at Curtiss Field, Garden City, was officially opened on May 15, when there was an excellent attendance of members of the Club and their friends. The weather was ideal and the program of flying events which had been arranged was well calculated to impress the spectators.

The outstanding event of the afternoon was the establishing of a new world's looping record for women by Miss Laura Bromwell. She used a Standard plane with K-6 motor, and succeeded in turning over 199 loops. As regular as clock work the roaring plane looped and looped, one second upright and the next on its back. Gradually the plane lost altitude, and as it drifted downward the loops became more apparent. They were clean cut loops, too, approving pilots on the ground declared. Each swoop downward added enough speed to the plane to bring it easily to the top of the great circle, with no side slipping or "falling out" of the evolution. About the 110th loop Miss Bromwell was near the ground, so she climbed upward, and at about 4,500 feet started looping once more. Again, still busily looping, she reached the danger zone just above the ground, and although the record was smashed to bits, soared again to 3,500 feet and looped some more. Finally, at 300 feet, she decided to call that part of the program over and landed.

Bert Acosta, who handles a plane as if he had a low opinion of his own value to the world, thrilled the crowds again and again by his daring stunts in an Orenco scout loaned for the occasion by the Army Air Service. There was nothing in the line of Immelman turns, barrel rolls, falling leafs, tail spins and vertical banks that he did not try out. Ansaldo pilots also did stunts.

Sergeant William H. Spare of Mitchel Field made a 3,000 foot drop from an army De Haviland and landed safely in his own field. W. E. Gilmore and Pilots Depew and Jones did some formation flying in three orange Curtiss Orioles. During the afternoon many spectators took flights in commercial machines.

After all the flying was over, some time around 7 o'clock, it suddenly occurred to a few members of the Aero Club to take a look at their field club. Until then all eyes and thoughts had been turned upward.

To Carry Diamonds by Air

London.—Aerial transport of diamonds is contemplated in the Belgian Congo by a mining company in which American interests are largely represented, according to African advices received here.

The mines concerned are at Djoko-Punda, in the Kasai Province. At present the journey by boat along the Kasai and Congo Rivers between the mines and Kinshasa, a distance of 500 miles, occupies thirty-five to forty days. By the use of aeroplanes it is expected to accomplish the trip in about two days.

Government Departments Co-operate to Aid Air Mail Service

The big new radio station in the Post Office Department building at Washington, D. C., which is to be used in connection with the Air Mail Service was formally opened April 22 by Postmaster General Hays and Secretary of Agriculture Wallace.

This very interesting event is an exceedingly important one because it marks the union of the Department of Agriculture, the Post Office Department and the Government Air Mail Service in an endeavor to establish a national radio marketgram service by the use of the various aid mail radio stations. The Government Air Mail Service now has major radio stations at the following points:

Washington, D. C.,
Bellefonts, Penn.,
St. Louis, Mo.,
Omaha, Nebr.

Through these stations and fifteen minor radio stations, operated by the Air Mail Service, together with more than 6,000 licensed amateur operators, almost every farmer in the entire United States may receive market reports each day as well as reports of other Government activities of interest to him. For a cost of from $50 to $75 the farmer can install a simple receiving set and receive market reports and weather predications at his farm.

At the present time the radio service of the Post Office Department is used only in directing aeroplanes in flight but it will be used, in the future, in handling a certain amount of Government business between stations. Plans are now under consideration to install a radio telephone apparatus which can be used to communicate with mail planes in flight at all air mail radio stations.

The Weather Bureau also plans to use the air mail radio service to distribute weather reports to various parts of the country.

Additional World Commissioners

The World's Board of Aeronautical Commissioners, Inc., has been increased to ninety-one members in seventy-three countries and colonies by the addition of the following:

Denmark—Copenhagen, Capt. H. C. Ullidtz.

Malta—Valetta, Capt. A. Zammit Cutajar.

New Brunswick—Rothesay, W. R. Turnbull, Esq., M.E.F. R.AeS.

Prince Edward Island—Charlottetown, H. R. Stewart.

Samoa—Apia, O. F. Nelson.

Transvaal—Johannesburg, Lt.-Col. Vicomte Rene de Sarigny, O.B.E.

Aircraft Garage in London

The old joke of asking aviators the question "Where is your garage?" has been exploded with the establishment here of a bona fide, plainly labelled garage intended for the use of aerial tourists. It has been erected by the De Haviland Aircraft Company at Staglane, Edgeware.

Here the owner of a private aeroplane can "drop in" with his runabout and have minor repairs made while he waits. The company's announcement says:

"A staff of highly skilled mechanics under fully qualified ground engineers. Petrol and oil supplied. Overhauls, modifications and repairs promptly executed."

The business is almost identical with that of the familiar automobile garage. Private aviators threatened with motor trouble, shortage of gas or loose controls have only to set down at Staglane, call a mechanic, pay the fee and take off again. Already several customers have patronized the new garage, including the chauffeur of a private De Haviland belonging to the Hon. Mrs. "Poppy" Wyndham, daughter of Lord Inchcape. Aeroplanes in which a person can fly anywhere at any time can be hired with pilots.

Personal Pars

D. C. Berry has been appointed chief engineer of the Wheeler-Schebler Carburetor Co. Mr. Berry was formerly Professor of Automotive Engineering at Purdue University and Research Engineer for the Hupp Motor Car Corporation.

Edwin G. Bolger, 2nd Lt. A. S. A., R. M. A., was married on March 24th to Miss Pauline Duncan, of Marion, Ill. Mr. Bolger during the war was stationed at various of the Texas flying fields, while his wife was in the service as a nurse.

Miss Cornelia B. McLoughlin, who recently qualified for her pilot's license in California. With her are C. Harding Babb and Emery H. Rogers

Canada Bars U. S. Fliers

The Manufacturers Aircraft Association received word May 11 that the Canadian Air Board had issued to all aviators operating aircraft in the United States a warning that they must not fly into the dominion without specific permission from the board. The association announced that there were 1,000 commercial aeroplanes in this country, a third of which were operated near the Canadian border.

The board's action was taken under the terms of the International Air Convention, which provides that the signatory powers maintain jurisdiction over civilian aviation by licensing pilots and certifying to the airworthiness of flying craft. There is no such Federal agency in the United States.

City Planning and Aircraft

Pittsburgh.—City planners should be able to forecast at least twenty-five years to provide for changes that aircraft will make in commerce, said John Ihlder, manager of the Civic Development Department of the United States Chamber of Commerce, addressing the thirtieth National Conference on City Planning at Pittsburgh on May 9.

"We are so young that all of the defects in our civic planning have not cropped out," he said.

An Interesting Test

To compare the time that may be made in transit by aircraft in the future and the time now required for a letter to go around the world Major Charles J. Glidden, President of the World's Board of Aeronautical Commissioners, Inc., now composed of ninety-three members in seventy-five countries and colonies, will on May 10th start four letters around the world, two eastward by a route north of the equator and two westward by a route south of the equator. The letters going by the routes north of the equator will be remailed by the Commissioner of the World's Board of Aeronautical Commissioners, Inc., in England, Ceylon and Japan. The letters going by the route south of the equator will be remailed by the Commissioner in England and New Zealand. An air line distance around the world north of the equator is 22,207 miles.

Hartford Landing Field

Work on the Hartford Municipal Landing Field is progressing rapidly and is expected to be completed in the very near future. The field was officially opened recently by Hiram Percy Maxim, President of the Hartford Aviation Commission, and the first air passenger to arrive on the field was Lieut. Chadwick, a former native of Hartford.

The following compose the Hartford Aviation Commission: Hiram Percy Maxim, President; Newton C. Brainard, Mayor; Samuel A. Miner, Treasurer; James B. Slimmon, Secretary; Harrison B. Freeman and Clarence M. Knox.

Oklahoma City Aerial Police

An aerial police force, auxiliary to the Police Department, is being organized in Oklahoma City.

Three planes for use in emergency have been donated the city by Mart H. Adams, auto dealer, 117 West Second Street. The planes are valued at $18,000. Other planes will be added, it was announced.

B. H. Griffin, pilot for Adams, will be named aerial police captain. He will serve for the salary of one dollar a year, according to plans.

Several local pilots have volunteered for the force, it was stated.

The planes will be used in scout duty in an emergency. They will stand ready to take the air at all times, Adams said.

Aerial Carnival in Houston

S. E. J. Cox, Texas aeronautic enthusiast, recently staged an aerial carnival at his flying field near Houston when some 10,000 spectators were present.

Amongst the flyers participating were: Burt Ison, H. C. Block, W. A. Showater, W. R. Schanhals, Henry Toncray and Dick Seal. The remarkable stunts of Dick Seal aroused widespread comment.

The feature of the day was the flying of Miss Mary Cox, adopted daughter of S. E. J. Cox, who is the youngest American aviatrix.

Planes and Smuggling

Ottawa.—The use of aeroplanes to smuggle drugs from incoming steamships on the Pacific Coast was charged by H. H. Stevens, of Vancouver, B. C., in the House of Commons, May 9th. Confederates aboard the ships, Mr. Stevens said, drop the drugs into the water, where they are spotted by the plane and later salvaged.

Air Route for Alberta

Edmonton, Alta.—The first commercial air route scheme in northern Alberta and beyond will commence operations by the end of May. Captain May, promoter of the project, is now at Camp Borden taking special training in aviation. He will return to Edmonton shortly with a navigator's license, three new flying boats for service in the North, and a crew of expert pilots. McLennan will be the base from which the air boats will fly. The route will be along the water courses via Fort Vermilion and Hay River, following the Peace and Mackenzie rivers to the Great Slave Lake and Fort Norman oil fields.

American Legion to See Aerial Carnival

When the delegates of the American Legion National Convention meet in Kansas City this fall they will see one of the most impressive aerial carnivals that has been staged in the United States. The Flying Club of Kansas City will have charge of the aerial events and the enthusiasm with which this organization is taking up the matter insures the complete success of the program.

The Ralph C. Diggins Co. is arousing aeronautic interest in Chicago by a poster campaign, of which the above is a reproduction

The AIRCRAFT TRADE REVIEW

Aircraft Insurance for 1921

The Executive Committee of the National Aircraft Underwriters Association has drafted coverages for the season's business. Several changes have been necessitated by reason of the heavy losses during the past year.

The Executive Committee felt that the rates must be kept down to as low a level as possible. When rates are already high, (as aircraft rates necessarily are) it does not ordinarily help the experience to any appreciable extent, to make the rates still higher. Some other way must be found to correct the poor experience. Flying conditions will undoubtedly improve from year to year and ways and means will also be found for reducing loss cost and repair bills; but the best opportunity of all for reducing the loss ratio appears to be in the adoption of a modified form of coverage, whereby the assured becomes a co-insurer.

It has been decided, therefore, that the Fire, Transportation, Theft, Windstorm and Collision coverages shall all embrace the 75% loss payable feature, whereby the company pays three-quarters of each loss (or three-quarters of the excess portion of each loss for each coverage that bears a deductible feature).

The companies hope to bring about a considerable improvement in the experience by the use of this clause. There is no question but what an assured will be a little more thoughtful and perhaps a little more careful if he knows that he is not to be fully reimbursed for each loss that may occur. Furthermore, aeroplanes depreciate very rapidly. An amount of insurance which is less than the market value of the plane at the time of insurance may easily prove to be in excess of the market value of that plane before termination of the policy period. It is true that the policy is written on a "non-valued" basis; nevertheless the assured is not always thoroughly familiar with the method of settlement and he carries in his mind principally the amount of insurance for which the plane is insured. He is apt then to be impressed with the thought that a total loss under certain circumstances might even prove beneficial to him, or in any event, that his share of the loss would be practically nil.

The remedy, then, is not only to remove any possibility of a benefit accruing to the assured by reason of a loss, but also to make it worth while for the assured to exercise extreme care in the maintenance and operation of the plane. It was decided that the best means of accomplishing this was through the adoption of the 75% loss payable clause. The companies writing aircraft insurance are anxious to help the aircraft business in every possible way. By placing a premium on carefulness, the companies are not only encouraging the prevention of accidents but they are also striving to place aircraft insurance on its own feet. The aircraft insurance business cannot long continue unless there are prospects of reducing the loss ratio to a normal level.

The Collision and Windstorm coverages are written with a 5% deductible amount, subject to a minimum of $250. The Theft clause is written with $100 deductible clause.

In writing seaplanes, the Windstorm and Tornado coverage is combined with Stranding and Sinking coverage into what is called "Mooring Perils". The regular Collision coverage for seaplanes is now called "Flight Collision".

Collision rates are slightly reduced for land planes where a warranty is attached to the effect that the plane shall remain at all times within gliding distance of a specified landing field.

Assembling Commercial Dirigible

The Commercial Airship Syndicate, Inc., are now assembling at their St. Louis plant the commercial dirigible which they plan to put in operation between St. Louis and Chicago.

The company is also negotiating for landing space for their Northern Division on which flying boats will be used, stops being made at Hannibal, Keokuk, Rock Island, Muscatine, Burlington, Dubuque, Davenport, La Crosse and Minneapolis.

The officers of the Commercial Airship Syndicate, Inc., are as follows: Charles Ora, President and General Manager; Joseph Schroeder, Vice-President, and Francis X. Slivka, Assistant Secretary. Amongst the directors are John Conway, S. H. Reed, C. L. Moses, Judge Hunter of Ft. Worth, Texas, William Frankman and Max Fritzter.

Western Airline Locates in Indiana

Through the co-operation of the Chamber of Commerce, the Engineering Division of the Western Airline Company has located at Seymour, Indiana, where the building operations of this company will be conducted.

The officers of the Western Airline Company are as follows: C. E. Lay, President; J. A. Andrews, Vice-President; L. P. Witherup, Chief Engineer; Myron S. Lay, Mechanical Engineer; E. L. Franz, Treasurer; L. C. Hodapp, Secretary.

Design Airship Slide-Rule

Washington—The design of a slide-rule for use in airship navigation has been completed by the Bureau of Standards and a report made to the three military and naval bureaus interested in this problem. Each report was accompanied by a model slide-rule. The report contained, in addition to the general description of the rule and its use, detailed instructions for laying off of all the scales and some thirty illustrated problems showing how to use the instrument. It is understood that a considerable number of these rules are being ordered by the air service.

Properties of Aerofoil Sections

The object of this report is to bring together the investigations of the various aerodynamic laboratories of this country and Europe upon the subject of aerofoils suitable for use as lifting or control surfaces on aircraft. The data have been so arranged as to be of most use to designing engineers and for purposes of general reference. It is the purpose of the committee to publish all existing tests on aerofoil sections, and present this information in a new form.

The absolute system of coefficients has been used, since it is thought by the National Advisory Committee for Aeronautics that this system is the one most suited for international use, and yet is one for which a desired transformation can be easily made. For this purpose a set of transformation constants is included in this report.

Each aerofoil section is given a reference number, and the test data are presented in the form of curves from which the coefficients can be read with sufficient accuracy for design purposes. The dimensions of the profile of each section are given at various stations along the chord in per cent of the chord using as datum the line shown on the curves. The shape of the section is also shown in reasonable accuracy to enable one to more clearly visualize the section under consideration together with its characteristics. The more accurately to obtain the dimensions of the profile of each section, a separate data sheet for each section has been included, which gives an additional decimal place for the greater portion of the ordinates.

The authority for the results here presented is given as the name of the laboratory at which the experiments were conducted with the size of model, wind velocity, and date of test.

Three separate indices are given—a chart index which makes it possible for a designer to select the wing section most suitable for a particular design he is interested in; a group index which is arranged in the same order as the curve sheets; that is, by countries and laboratories at which tests were conducted, each section also being designated by a reference number; and an alphabetical index.

In order that the designer may easily pick out a wing section which is suited to the type of machine on which he is working, four index charts are given which classify the wings according to their aerodynamic and structural properties.

A copy of Report No. 93 may be obtained upon request from the National Advisory Committee for Aeronautics, Washington, D. C.

Wilmer Heads Goodyear

Edward G. Wilmer, Vice-President of the Steel and Tube Company of America, has been elected President of the Goodyear Tire and Rubber Company, to succeed F. A. Seiberling. There has also been a reorganization of the board and the elimination of five of the former members from the corporation's management.

The following Directors have been elected: J. P. Cotton of Franklin, McAdoo & Cotton, New York; P. W. Litchfield, Akron; Grayson M. P. Murphy, New York; J. R. Nutt, President of the Union Trust Company of Cleveland; Robert C. Schaffner of A. B. Becker & Co., Chicago; A. A. Schlesinger, President of the Steel and Tube Company of America, Milwaukee; G. M. Stadelman, Akron, Ohio; Ralph Van Vechten, Vice-President of the Continental and Commercial Bank of Chicago, and Edward G. Wilmer of Milwaukee.

THE ACTUAL STATE OF THE HELICOPTER PROBLEM

By DR. G. DE BOTHEZAT

THE helicopter problem has again been brought to the general attention by a few attempts made in different countries to realize such flying apparatus. For this reason a few competent remarks on the actual state of this problem would be at present not without interest.

The *helicopter* is understood to be a flying apparatus where the lift is derived from rotating blade-screws.

A helicopter, in order to actually fly, must not only be able to lift itself but must also be fully *stable* and *manoeuverable,* and in addition, must be able to safely reach the ground in case of the stoppage of the motor. A clear idea of how the helicopter will behave when free to move in space must first be gotten before the requirements of design can be met. I will give a short survey of these different sides of the question.

I. *The Lifting Problem*

The present state of the blade-screw theory is such that it is not difficult to design and build helicopter screws that can secure a very high lift, and the difficulty in the realization of helicopters is not at all in this problem. In Fig. C is given a general picture of the thrusts per horsepower that can be secured by helicopter screws. This figure has been established for a first checking and must be considered as giving rather an underestimate of what can be really realized; which means that the data here furnished shows only the minimum of what can be expected from a helicopter-screw and by a careful design these performances can be easily exceeded. As abscissae, are plotted the helicopter screw diameters and as ordinate, the thrust per horsepower. The two systems of curves give the corresponding total horsepower and numbers of revolutions per second. For example, a helicopter-screw absorbing 10 h.p. and having 6 meters in diameter will be able to furnish 10 klg. thrust per horsepower when turning 2 revolutions per second. This means that the total thrust would be 100 klg. for the 10 h.p. If for the same power the diameter of the helicopter-screw would be reduced to 4½ meters then at around 3 revolutions per second, such blade-screw would give us only 8 klg. per horsepower, that is, 80 klg. for the whole power. One can see how easily any power or size relation concerning helicopter-screws can be answered by this diagram and that helicopter-screws when properly designed can with ease furnish the thrust necessary to lift a helicopter with its powerplant and pilot. The data used in the establishing of this diagram are of such reliability that they illustrate the relations which hold in the present case with great accuracy. Those more interested in the subject will find complete particulars concerning this diagram on page 77 of the author's blade-screw investigations.* I will mention here that several blade-screws built and tested by the author have more than justified the data here furnished.

A point of interest is, that it is easier to get a high lift per horsepower from a smaller power blade-screw than from a higher powered one. The helicopter-screw must only make a number of revolutions appropriate to power and diameter selected in order to work in efficient conditions. The study and discussion of all such subjects as helicopter-screw efficiency and general method of the design will be found in the author's Blade-Screw Theory above mentioned. The general conclusion to be drawn is: With the knowledge actually available helicopter-screws securing the necessary lift can be built with ease. The foregoing diagram is here given to justify this opinion. It is only ignorant inventors who think the whole helicopter problem consists in the building of the lifting screws, although they usually do not even reach so far. It is necessary to bring attention to this state of this question. It must be remembered that the blade-screw problem is one of the most difficult problems of modern aerodynamics and no one can hope to familiarize himself with it in a few days. But those at the level of the present state of knowledge and experience on this subject know well that there is nothing to invent in order to build a helicopter-screw giving a high lift.

II. *The Problem of the Descent When Motor is Stopped*

Insofar as is known to him, the author was the first to investigate the blade-screw problem in such generality as to discuss all the possible states of work of a blade-screw and among which the brake state is to be found. The situation stands thus: Different brake states are possible for a blade-screw. Two of these brake states which I call the first and second brake state require that power is applied to the blade-screw in order to get the braking action. These brake states can thus not be used in the helicopter case. The third brake state is, exactly speaking, the turbine or wind mill case. Usually a wind mill is used as a generator. But, as well known, the wind mill when working produces an axis thrust which is usually balanced by proper bearings. But in the helicopter case, when the motor stops and the helicopter is obliged to descend it is possible to make its blade-screws work as wind mills and simply use the axial thrust thus produced to brake the descent of the helicopter. In order to reach this result it is only necessary to design the helicopter screws so as to secure a high braking action of the kind above explained and that a proper resistance be provided to be overcome by the helicopter screw when rotating as a wind mill. Under such conditions the same helicopter screws which secure the lift of the apparatus when the motor power is furnished to them, will secure the descent, when motor is stopped, working as wind mills, the power being absorbed by a special device. Thus one must not think that the helicopter will simply drop down if its motor stops, but its blade-screws are able to secure the descent if properly designed. For all qualitative relations referring to the braking action of blade-screws, the reader is referred to the author's "Blade-screw Theory", especially its Chapter II. The figures A and B of this chapter give a general picture of all the states of work possible for a blade-screw and the relation of the lifting state of work (marked 1 in figure B) to the wind mill braking state can easily be seen (marked 4 in figure B). In the question of slowing down of the descent of the helicopter, there is in principle nothing to invent but only to use properly the knowledge available.

I apologize for having to refer so much to my own investi-

* "The General Theory of Blade-Screws," by *Dr. G. de Bothezat* published by the National Advisory Committee for Aeronautics, 1918, Washington, D. C. This memoir will be referred to in the following simply as "Blade-Screw Theory."

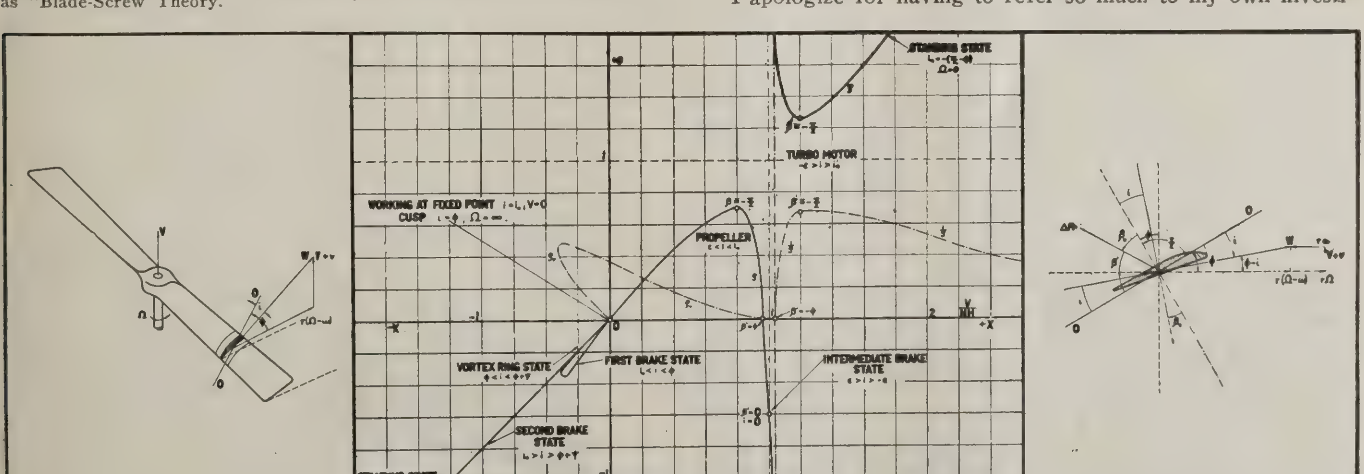


FIG. A

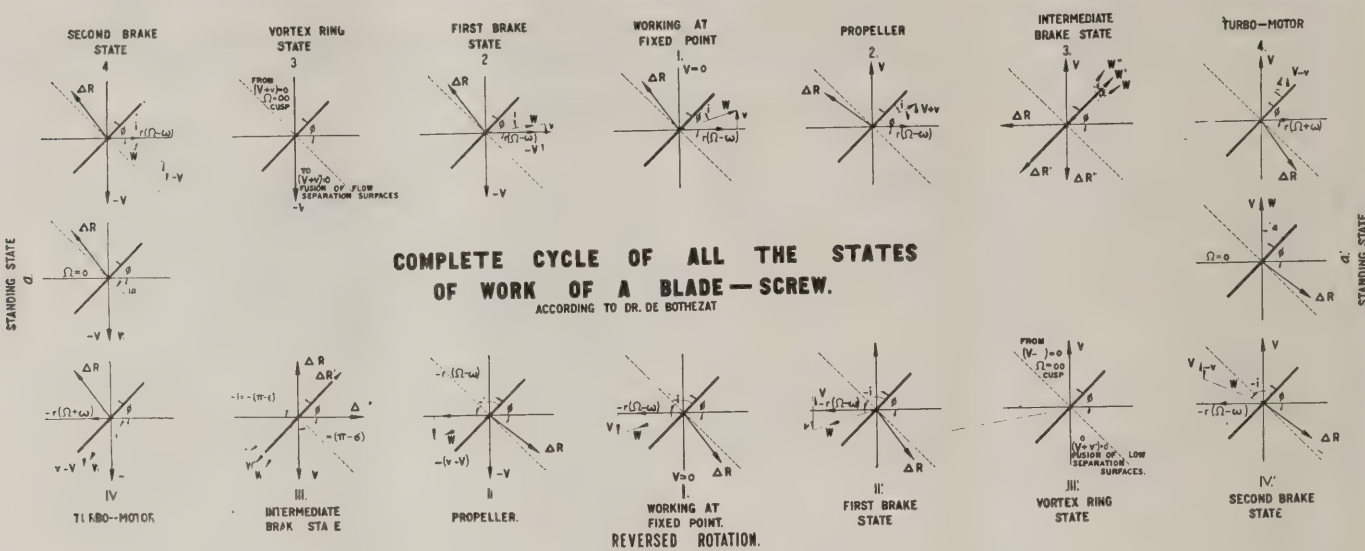


FIG B

gations on the subject but I do not know of any other investigations which have treated especially this braking action of the blade-screws, with the necessary generality.

III. The Behavior of a Helicopter When Free to Move in Air

I think it will not be without interest if I will explain a little in detail as to what will be the general behavior of a helicopter, when it has hopped off and is left free to move in the atmosphere.

I will first mention that it is quite a naive idea to imagine that the helicopter will rise and fall exactly vertically through the point of its start. The trouble is that most usually we have winds in the atmosphere and once a helicopter has hopped off, it will be immediately carried away by the wind in the same manner as a spherical balloon. If we would like to have the helicopter remaining nearly over the place of start, we must equip our apparatus with the means of propulsion able to communicate to the helicopter a translational speed equal and opposite to the wind speed. It is only if the helicopter will be able to move against the wind with the speed of the wind that we will be able to keep an apparatus over the place from which we have started. We thus see that if we do not want the helicopter to be carried away by the wind we must secure its propulsion at the speed of the wind. The magnitude of the wind speed fixes the lower limit of the horizontal velocity that a helicopter must be able to develop. If we want the helicopter to be able to travel, as we certainly do, we must even secure for the apparatus the possibility of developing horizontal velocities greater than the usual wind velocities. This means that the helicopter in order to be really useful must be able to develop horizontal velocities of the same range as the actual aeroplanes. It is just on account of this fact that the following must be well understood. Lifting screws and propulsive screws are of a totally different nature. A screw giving a high efficiency as a lifting screw is of no good as a propulsor. On the contrary, a good propulsive screw is a very poor lifting screw. This brings us to the very important conclusion that a helicopter reasonably conceived must have for its propulsion a special separate propeller, and that the lifting screws must not be used for the propulsion. An additional fact in favor of the last is that if a lifting screw (whose axis is vertical) is moved in a horizontal plane, and thus will have to work in a relative horizontal wind sweeping the plane off its rotation, the lifting ability of a helicopter-screw is not decreased but, on the contrary, some experiments have even shown that there is a tendency to the increase of the thrust. Thus the propulsion of the helicopter will not unfavorably affect the work of the lifting screws. But the helicopter-screws as such are unable to secure an efficient propulsion. It is thus clear that a helicopter must have a special propulsive-screw or propeller in order to secure its propulsion with a good efficiency. This question of an efficient propulsion is even of first importance because the power demanded by a helicopter will be,—for the first helicopter at least,—somewhat bigger than the power absorbed by an aeroplane of the same carrying capacity and same speed of travel and thus no waste of power can be tolerated. *We have thus reached the fundamental conclusion that a helicopter rationally conceived must, in addition to its lifting-screws with vertical axis, have also at least one special propulsive-screw or propeller with a horizontal axis.* Concerning the lifting-screws there must be at least two of them in order to balance the two reactive torques. All proposed types of fins for the balance of the reactive torque of a helicopter-screw are rather unhappy propositions which complicate the question without satisfactorily solving the problem. Thus only the propulsed helicopter will really be able to hover over its starting point and be able to land, in the usual case of winds, with a small ground speed.

Let us imagine now that on a perfect, still, windless day a helicopter has just hopped off and its propulsive screw is at a standstill. What will be its general behavior? It is easy to realize that it is impossible to expect that the lifting-screw will give a thrust directed exactly along the vertical. Ideal conditions exist only in the imaginations of men. In addition, the slightest disturbance, a slight wind gust, etc., will incline the helicopter. If the thrust furnished by helicopter-screws will be admitted as not perfectly vertical, this thrust with the helicopter weight, which is always exactly vertical, will give rise to a resultant side force, which will produce a side slipping of the helicopter. The idea to have well in mind is that a helicopter as soon as it has hopped off will show a tendency to side slipping and this side slipping will be quite a natural phenomenon. Thus the first quality a helicopter must have is to be built in such a way that the pilot may have control of this side slipping, that is to be able to check it when it starts and to be able to provoke it when necessary. The fact is that by the aid of this side slipping a certain translational motion of the helicopter may be secured. The pilot may rise to a certain height, then side slip, then rise again, then side slip again and so on, because during the side slipping a loss of altitude will usually occur.

We can now see the kinds of evolutions that the helicopter may perform. The helicopter may rise vertically or descend, during which rising and descending, side slipping can occur. The helicopter can also have a translational motion produced by its propulsive screw when working simultaneously to the lifting screws. It is during all these evolutions that the complete stability and manoeuverability of the helicopter has to

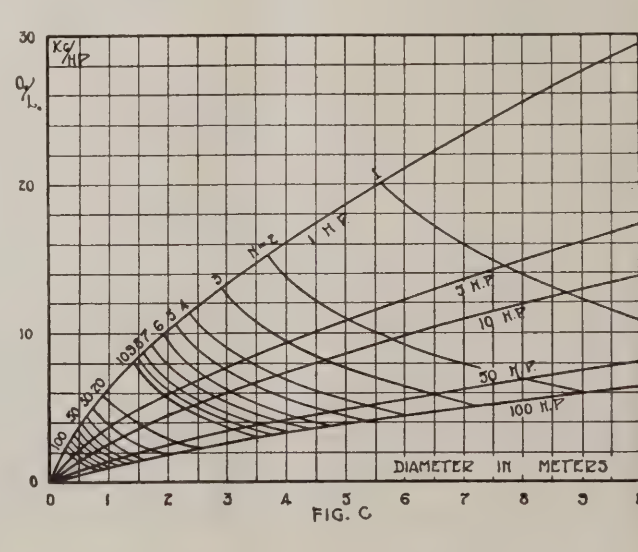


FIG. C

be secured. And it is just this stability and manoeuverability of the helicopter that has to be the more thoroughly thought through. It is clear that this stability and manoeuverability cannot be secured by rudders such as in the case of the aeroplane, because during the lifting or descending the relative winds will be very weak, if any, and the rudders will not act. Thus, for the stability and manoeuverability of the helicopter special devices must be provided. A detailed investigation of this question has brought the author of this note to the conclusion that such stability and manoeuverability of the helicopter can be fully secured by very simple means based on the knowledge of the properties of blade-screws. In principle the stability of the helicopter is the more closely connected with the aeroplane stability and a good knowledge of the last is the first step for the understanding of the helicopter stability. The author's investigation of the aeroplane stability, published in Paris in 1911, can be with much profit consulted on this last subject. Aeroplane and helicopter stability have this in common, both are vehicles free to move in space, which is not the case for ships and automobiles that move in one plane. Aeroplane and helicopter stability are especially similar when the helicopter has a translational velocity.

IV. Practical Importance of the Helicopter

It must not be thought that the helicopter presents an interest only as a pure and simple scientific curiosity. On the contrary, the helicopters will find many very important applications.

First of all, the helicopters will, with great advantage, replace observation balloons because they will be a much less visible target and, in addition, the great trouble of carrying the balloons filling gas is wholly avoided.

Afterwards, in many instances, the helicopter will, with great advantage, replace aeroplanes. A properly propulsed helicopter being able to fly quickly in the same manner as an aeroplane can in addition perform other very important evolutions. Thus the helicopter will have a speed range from zero up to its maximum which is out of reach for the aeroplane. From this last fact there follows for the helicopter such a big set of applications which the aeroplane is unable to fulfill, that it is rather impossible to enumerate them all. The reader will with ease be able to find such applications.

The realization of the helicopter must thus be considered a very important step in the progress of aeronautics.

I hope this short survey will give a general idea as to how the helicopter problem stands. Actually we have all the necessary knowledge on hand in order to build a helicopter, and such an apparatus can be built, even with small expense, in a rather short time. Even no preliminary tests are necessary so clear are all the relations that hold in this case. If the helicopter has not been realized until the present, it is only because those who have the facilities and possibilities to do it are usually ignorant on the subject. The usual helicopter inventor thinks that the entire problem is in securing the necessary lift. He concentrates all his attention on the last and because he is totally ignorant about blade-screws, is unable to even reach so far. If the building of helicopters would have been left to men of knowledge on the subject, it would have been long since realized.

THREE YEARS OF THE AERIAL MAIL

The Air Mail Service was three years old May 15. During the past year it had a general average performance of 78 per cent of trips completed and 83 per cent of miles completed. Its best general monthly average performance was 95 per cent in July, 1920. It had a general average performance of 90 per cent of trips completed during April, 1921, when the very worst weather of the year prevailed. Violent snow storms over the Rocky Mountain district and dense fogs and cloudy conditions were encountered during that month over the eastern portion of the air mail routes.

The New York-Washington route has completed its eighth consecutive week with 100 per cent performance.

During the past year the Air Mail Service has covered 1,313,379 miles with mail. It carried 1,015,053 pounds of mail which amounted to 40,602,130 letters. The cost of its operation for the year, with April estimated, was $1,342,362.67. The average cost per mile was $1.02.

Routes Now in Operation

The routes now in operation are the transcontinental route from New York to San Francisco via Cleveland, Chicago, Omaha, Cheyenne, Salt Lake and Reno. A route from Chicago to Minneapolis; another route from Chicago to St. Louis, and the route from Washington to New York.

Fatalities

The fatalities for the past year were 13 pilots, 5 mechanics and one official, almost twice as many as for the first two years. This, to a certain extent, was due to the greater hazard of operating the transcontinental route, which was established during the year, over two ranges of mountains, while the operation of the Air Service for the first two years was confined almost entirely to the Washington and New York route. Seven of the fatalities were due to defective mechanism of a certain type of plane which has been discarded, six of the fatalities occurred while not carrying the mail, either on the field or in ferrying ships to various points.

The loss of these lives is the distressing feature of the development of aerial navigation. Every effort is being made by the Air Mail authorities to develop devices and aeroplane mechanism which will prevent as far as possible these unfortunate accidents. Each accident and every experience in cross country flying increases the knowledge of aviation both for national emergency and for commercial aeronautics. Every great advance in science more or less pays its toll in human life.

Flying Difficulties

The difficult part in aviation is flying over the mountain ranges. On the air mail route from New York to San Francisco the Allegheny Range is encountered with a great many fogs and low hanging clouds at certain seasons of the year, while on the western end of the route the Rocky Mountain Range with its many blizzards is encountered. Under these conditions pilots usually fly low and follow valleys and river courses if possible. Flying at a speed of ninety or one hundred miles an hour, it is difficult to recognize localities with only a momentary glimpse of an object in a fog or storm.

It is not the policy of the Post Office Department to require pilots to start on their trips under weather conditions that will endanger their lives, but they sometimes meet with bad weather conditions after starting which cannot be forecast. In their eagerness to complete their trips and test their flying skill under these difficulties, they sometimes fly blindly over cities and mountain ranges not knowing what moment they may crash into some tree, mountain side, or other obstacle. Quick thinking and action are required, as well as nerve, in such emergencies.

Flying Experiences

The experience of one aviator flying over the states of New Jersey and Pennsylvania in his flight from New York to Bellefonte, Pennsylvania, is given in a report, in part, as follows:

"The ceiling was 75 feet," says the aviator, referring to the distance from the ground to the foggy or cloudy conditions, "and the visibility poor. I followed the shore of Staten Island when the ceiling closed down to almost zero. Flew blind over South Amboy, followed railroad to the Delaware River below Trenton, intending to follow the river to Allentown. Turned up the river and flew blind through several places where the fog was right down on the water. Tried to follow the right bank of the river, caught glimpse of shore but turned too quickly and lost it. Picked up the left bank in the same manner, then the right again. Turned and a steep hill loomed up 50 or 75 feet ahead. Opened the motor wide and tried to fly over it; succeeded in getting to the top just clearing the tree tops when the ship stalled. I pushed the nose down as much as I could without deliberately diving into the trees and came to an open space in the last spare second. I pushed the nose still further down and was picking up speed when trees loomed up again with 75 or 100 feet away, considerably higher than I was. Not having sufficient speed a crash was inevitable. I closed the throttle and pulled the stick clear back about one second before the landing gear struck the ground eight feet from a stone wall and a row of trees. The ship went on her nose and the tail crashed into the trees which prevented it from going further."

Another aviator flying over the same route says: "Flew at 2,000 feet catching occasional glimpses of the ground until reaching the Delaware River, which I was able to see through a hole in the fog. Dived down to the river and attempted to fly down stream. This proved to be impossible owing to the fact that the fog was right on the water and no ceiling." This pilot states that he climbed through an upper stratum of clouds breaking through at 7,000 feet. After flying for some time he saw a black spot in the clouds and dived down through it to within 85 feet of the Lehigh River. Thus he continued up through the clouds to find a clear place and then down again through a hole in the clouds endeavoring to find his locality. Engine trouble developed before he was able to locate himself and he was obliged to alight among some trees on the mountain side.

One of the air mail pilots whose machine crashed into the mountain side near Jasper,

(*Concluded on page* 262)

ALUMINUM PISTONS

By FRANK JARDINE and FERDINAND JEHLE

(Concluded from last week)

Operation Temperatures of Pistons

Several years ago we conceived the idea that much could be learned by actually measuring the temperatures of pistons in operation in an engine. For this purpose a single-cylinder Liberty engine was utilized. It was thought best that some means should be provided for conducting the thermocouples out of the engine without subjecting them to any bending whatever. To accomplish this it was necessary to run a straight tube from the piston down through the crankcase. Due to intereference between this tube and the standard crankshaft and connecting-rod these parts had to be redesigned. This required much time, and it was not until about a year after the design was made that the first tests were started.

A general layout of the apparatus in its early stages is shown at the left of Fig. 2. The couples terminated at the cold junction point shown in the diagram and the leads from there to the potentiometer were made of piano wire. This arrangement looked very promising for a while, but it was too heavy and the fastening connecting the piston to the tube was broken. It was then decided to eliminate the pantograph arrangement and let the piano wire form the connection between the cold junction and the potentiometer unsupported. To eliminate vibration of the wires as much as possible they were placed in narrow channels which permitted motion in only the vertical plane. The upper right portion shows this set up while a more detailed arrangement of the channels is given underneath.

Fig. 3 is a diagram of the pistons showing how the couples were attached and their location. Couple No. 1 is in the center of the head, No. 2 is on the intake side at right angles to the plane of the wrist pin, 1 5/8 in. from the center of the head, No. 3 is on the intake side below the rings, 2 in. from the top of the head, and No. 4 is located 1/4 in. from the bottom of the skirt, also on the intake side. Several methods were used at different times for fastening the couple to the piston and two are shown in Fig. 3. The first one was to drill a comparatively large hole about 1/4 to 3/8 in. in diameter partially through the piston and a small hole the rest of the way. The couple was inserted through the small hole and bent over as shown, and a plug screwed tightly against it. This gave very satisfactory results. The point was raised, however, as to whether or not the plug had a sufficiently good contact with the rest of the piston to insure that it was not hotter than the piston itself. To investigate this point some of the couples were inserted in a similar way to the one outlined except that instead of inserting the screw plug the large hole was closed by welding. This was rather a difficult weld to make but those pistons in which the weld stood up showed no difference in temperatures over those using the screw plug. In all cases the head-couples were inserted 1/16 in. from the inside of the piston.

The results of the piston temperature tests given below are not considered as final but are sufficiently conclusive to indicate the temperature distribution in pistons. The first tests were made with a piston designed according to the Hall formula mentioned above. Even the preliminary tests made with these first pistons showed that the heat did not follow the outlined path to the water-jacket. The greatest temperature drop was noted between couples Nos. 2 and 3, that is, through the rings, while the drop through the skirt was not as large as that through the ring section. At this point we would like to bring out the similarity between the results obtained by Arthur A. Bull of the Northway Motor & Mfg. Co. and ourselves, although Mr. Bull's work was done on a stationary piston in a water-jacketed cylinder.

It was then decided to make up several pistons of different thicknesses and constructions and note the difference in temperature distribution. Fig. 4 is a set of detail drawings of the pistons that were used. The amount of metal in each one is best expressed by the weights, which are, from left to right, 3.9 lb., 3 lb. and 2.5 lb. Since it was not certain that the apparatus would work at high speeds, it was thought best to make all of these tests at 800 r.p.m. or as nearly that speed as possible. Fig. 5 shows the results obtained from these tests on the different pistons, the figures around the outline indicating the temperature at the various points and the drop between them. The average speed of all the tests was 800 r.p.m., the average brake horsepower 13, and the average cooling-water temperature, inlet, 126 deg. Fahr. and outlet, 147 deg. Fahr. In the piston at the left, which was the heaviest, the drop across the rings was 280 deg. Fahr. and the drop across the skirt only 105 deg. Fahr. In the next lighter piston which is shown in the center the drop across the rings was 349 deg. Fahr., and the drop across the skirt 43 deg. Fahr. In the lightest piston tested, that at the right, and which incidentally had two cross ribs, the drop across the rings was 394 deg. Fahr. and the drop across the skirt was 83 deg. Fahr. It is interesting to compare these results and at once it becomes apparent that in spite of any section we can put behind the rings and on the skirt the greatest temperature drop is across the rings. It is therefore very obvious that the original Hall idea of by-passing the rings is not absolutely correct. It is just as apparent, however, that the amount of metal behind the ring grooves does affect the temperature drop. Comparing the three pistons we find that the drop across the rings is less when more metal is used behind them.

Calculating a wall area based on the power developed by the engine at this speed we would get an area slightly less than the one shown at the right of Fig. 5. It would therefore seem that the formula developed for wall area does not call for too much metal, in fact slightly more would do no harm. The piston mentioned is a trifle on the thin side for mechanical reasons and more metal should be added on that account. The formula for wall area behind the rings should, therefore, for the present at least, be adhered to. The results would seem to indicate, however, that it is not necessary to

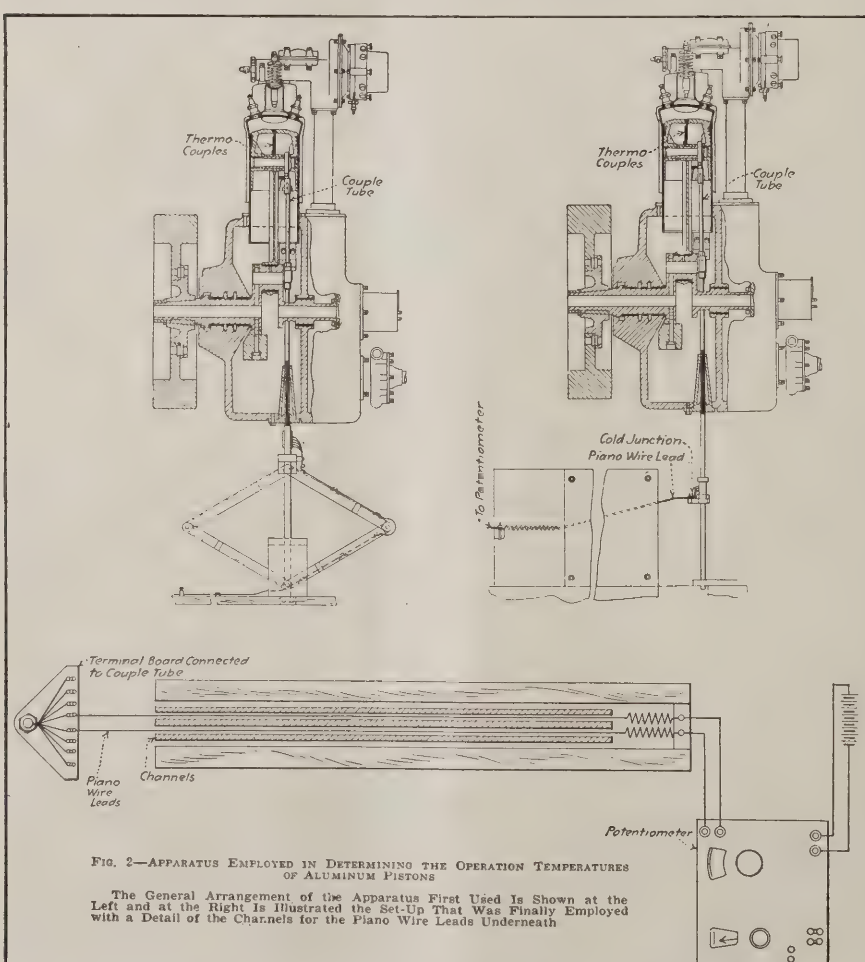
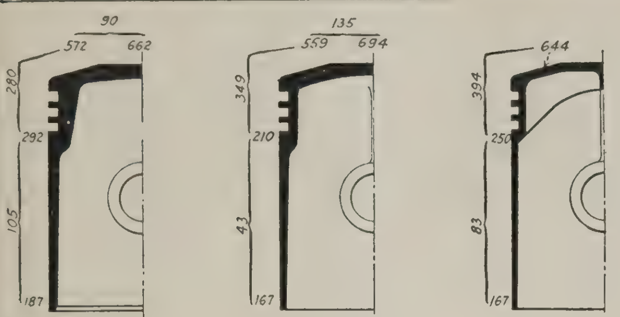


FIG. 2—APPARATUS EMPLOYED IN DETERMINING THE OPERATION TEMPERATURES OF ALUMINUM PISTONS

The General Arrangement of the Apparatus First Used Is Shown at the Left and at the Right Is Illustrated the Set-Up That Was Finally Employed with a Detail of the Channels for the Piano Wire Leads Underneath



Speed, r.p.m.	800	800	800
Brake horsepower	12.9	13.1	13.2
Inlet Water Temperature, deg. fahr.	128	126	126
Outlet Water Temperature, deg. fahr.	148	145	147

Fig. 5—Results Obtained from Tests of Different Pistons Showing How Variation in the Design Affects the Temperature in Operation

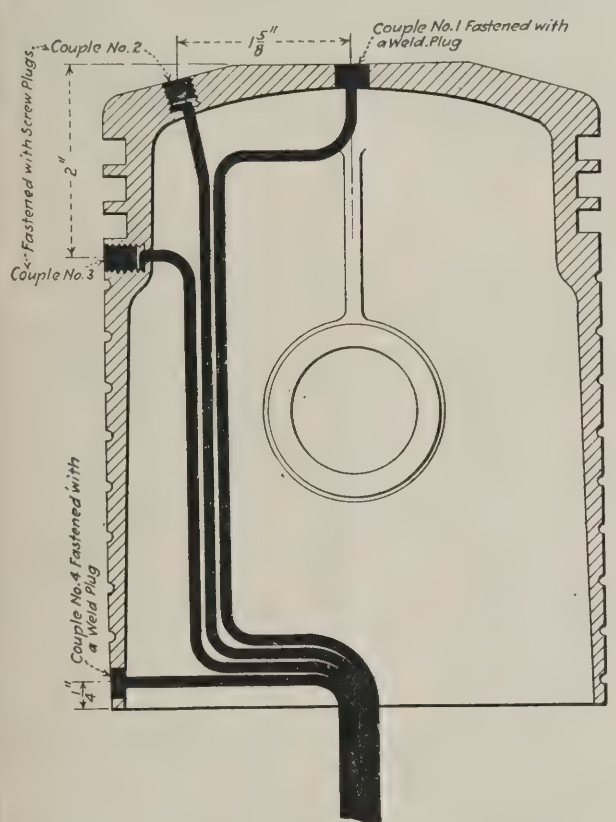


Fig. 3—Arrangement of Thermocouples in the Pistons

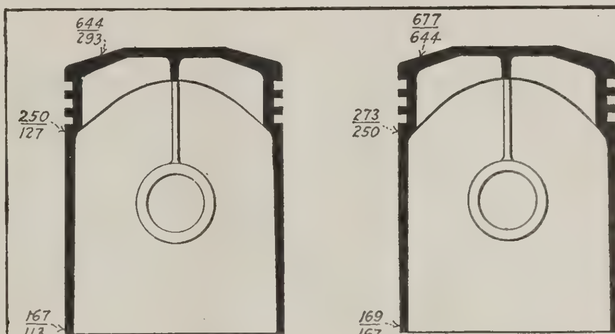
have as much metal immediately below the rings or in the section *e-e* in Fig. 1. The skirt thickness should therefore be determined largely by casting, machining, and other mechanical requirements.

The next interesting point to be considered is the temperature of the head. Unfortunately more trouble was encountered with the couple in the center of the head than with the other couples used and in the one case, that of the piston at the right of Fig. 5, no successful reading was obtained. By comparing the other pistons, however, we can see that some difference can be laid to the thickness of the head. A difference of 32 deg. Fahr. was recorded between the center head temperature of the pistons at the left and center. The temperature toward the side of the head as measured by couple No. 2 was actually a few degrees higher in the thicker piston. This can be explained in three ways, (*a*) the difference of 12 deg. Fahr. is possibly as close as any two pistons of the same design would operate, (*b*) it may show that for the amount of horsepower developed the central piston had a head of sufficient thickness, and that a greater thickness would not be of any benefit, and (*c*) the temperature difference across the thinner head would naturally be greater than that across the thicker head. Couple No. 2, in the lightest piston shown at the right of Fig. 5, however, was 72 deg. Fahr. hotter than the similar temperature for the piston at the left. That, without a doubt, is due to the head thickness. According to the formula the first of these two pistons had a head thicker than necessary, but the temperatures obtained would seem to indicate that it was not too thick. If more taper had been used, that is, if the head had been made thicker where it joins the skirt the temperature of 644 deg. Fahr. would have been reduced somewhat. Until such time as further work can be done it is wise to adhere to formulas outlined above because passenger-car pistons designed in that way have given good results.

Comments on the Tests

In making these temperature tests other troubles were encountered besides the mechanical workings of the parts. It was discovered that piston temperatures, especially that of the head, were very susceptible to changes in fuel consumption. A sufficient amount of data has not been collected on this subject for presentation in this paper, but we can state that it warrants further investigation. All the tests reported herein were made with the same fuel consumption.

It was also discovered that changes in cooling-water temperatures brought about a marked difference in the piston temperatures. The temperature at the lower end of the skirt is dependent, largely, upon the temperature of the cooling water. Sufficient time was not available to go into this problem as thoroughly as would have been desirable, but enough data was collected to show the effect of an extreme change in water temperatures as shown at the left of Fig. 6. Unfortunately these tests were made on the piston in which the center head couple was inoperative. Couple No. 2 on the head, while the inlet cooling-water temperature was 126 deg. Fahr. and the outlet 147 deg. Fahr., indicated a temperature of 644 deg. Fahr. When the water temperature was reduced to 48 deg. Fahr. for the inlet, and 58 deg. Fahr. for the outlet, this temperature dropped to 293 deg. Fahr., that is, it dropped 251 deg. Couple No. 3, below the rings, showed a drop of from 250 to 127 deg. Fahr., or 123 deg., for the same change in cooling-water temperature. Couple No. 4 at the bottom of the skirt fell from 167 to 113 deg. Fahr. It is also



The Upper Temperature Readings Were Obtained at a Speed of 800 R.P.M. and Brake Horsepower of 13.2 and Inlet Water Temperature of 126 Deg. Fahr. and an Outlet Temperature of 147 Deg. Fahr. The Corresponding Values for the Lower Readings Were 800 R.P.M., 14.0 B. Hp. and 48 and 58 Deg. Fahr.

The Upper Temperature Readings Were Obtained with a Speed of 1000 R.P.M. and 16.2 B. Hp. and the Lower with a Speed of 800 R.P.M. and 13.2 B. Hp. The Inlet Water Temperature Was 126 Deg. Fahr. and the Outlet 147 Deg. Fahr. Throughout

Fig. 6—Temperature Differences Due to At the Left a Variation in Cooling Water Temperatures and At the Right a Change in Speed

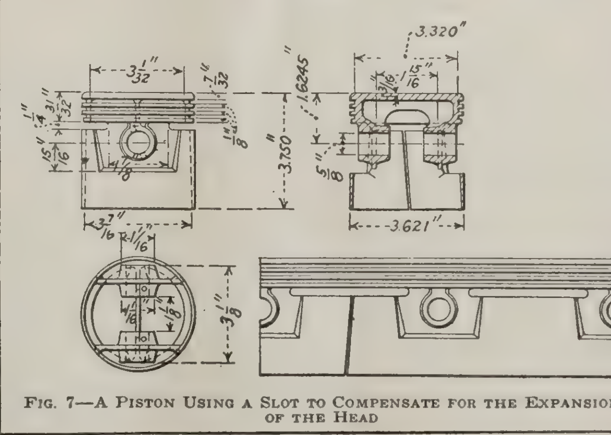


Fig. 7—A Piston Using a Slot to Compensate for the Expansion of the Head

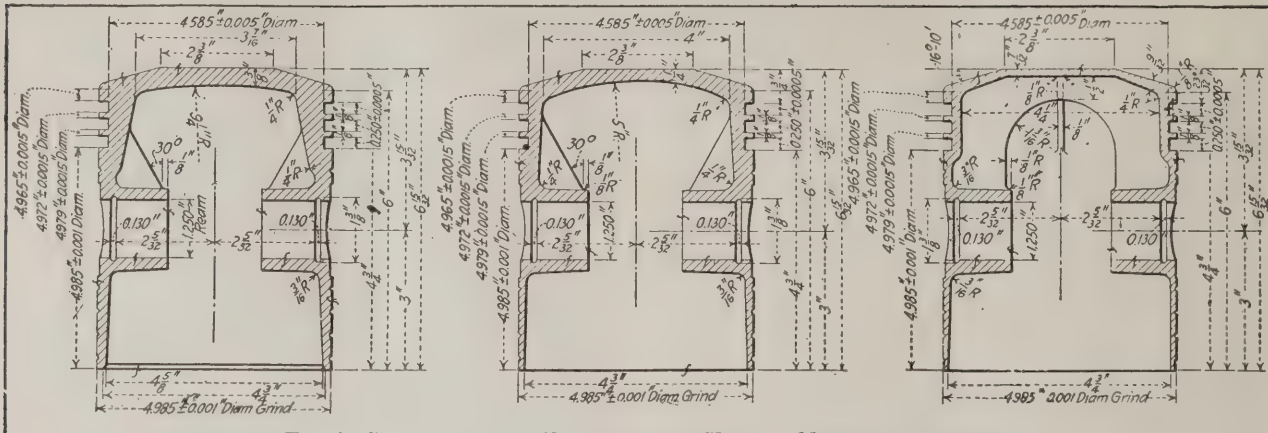


FIG. 4—SECTIONS OF THE THREE PISTONS USED IN MAKING THE TESTS

interesting to note that the drop across the rings decreased from 394 to 166 deg. Fahr. and that across the skirt from 83 to only 14 deg. Fahr.

Due to a lack of time it was not possible to study thoroughly the effect of engine speed on the temperature. The right half of Fig. 6 gives the result of one set of tests made at 800 and 1,000 r.p.m. The water temperature of both tests was held at 126 deg. Fahr. for the inlet, and 147 deg. Fahr. for the outlet. The horsepower at 800 r.p.m. was 13.2 and at 1,000 r.p.m. it was 16.2 h.p. The head temperature was increased from 644 deg. Fahr. at 800 r.p.m. to 677 deg. at 1,000 r.p.m., an increase of 33 deg. The temperature below the rings was increased from 250 deg. Fahr. at 800 r.p.m. to 273 deg. at 1,000 r.p.m., an increase of 23 deg. The temperature of the lower end of the skirt remained the same; the increase of 2 deg. from 167 to 169 deg. is not outside the limits of error. Judging from the results so far obtained the speed has little effect on the skirt temperature. Before stating this definitely more tests should be run and such tests are contemplated.

Clearance Required

As shown by the tests much of the heat leaves through the rings. The temperature immediately below the rings is at times several hundred degrees lower than the head temperature. Since thermal expansion is a function of the temperature it would seem, offhand, that this state of affairs would be ideal. We know, however, that the clearance required for aluminum pistons is much in excess of that necessitated by skirt temperatures. There can be only one explanation of this and that is, that the hotter piston head will cause a mechanical expansion of the skirt in addition to the thermal expansion due to its temperature. The force set up in a structure due to its temperature is really enormous, as a simple calculation will show.

Modulus = Unit force ÷ Unit deformation

then

Unit force = Modulus × Unit deformation
Modulus for aluminum = 10,000,000
Unit deformation for 1 deg. Fahr. rise = 0.000012 in.

Substituting

Unit force = 10,000,000 × 0.000012
= 120 lb. per sq. in. per deg. Fahr.

Bearing in mind that the difference between the skirt and head temperatures is at times several hundred degrees we can get some idea of the magnitude of this force. There can, therefore, be no question that the expansion of the head is accountable for much of the clearance which must be given to the skirt of a piston.

If the skirt could be entirely separated from the head the clearance could be greatly reduced. It is not practical, however, to separate the head entirely, but it can be separated from certain portions of the skirt so as to relieve the skirt of mechanical expansion in certain directions. The most reasonable place to reduce the expansion in this manner is across the thrust faces. A saw slot immediately below the lower ring on both the thrust faces will bring about this condition. The mechanical expansion of the skirt in the direction of the axis of the wrist pin will remain unaltered and some means must be provided for making this expansion harmless. This can be done by relieving these faces for their entire length or providing some flexibility by a slot. Both methods have been used and have given satisfaction. By separating the skirt from the head we eliminate mechanical expansion in one plane, that is, across the thrust faces. Supposing we consider a piston with its head and skirt separated as just mentioned, running under conditions such as were shown in some of the temperature charts, with an average head temperature of 600 deg. Fahr., a rise of 530 deg. above room temperature,

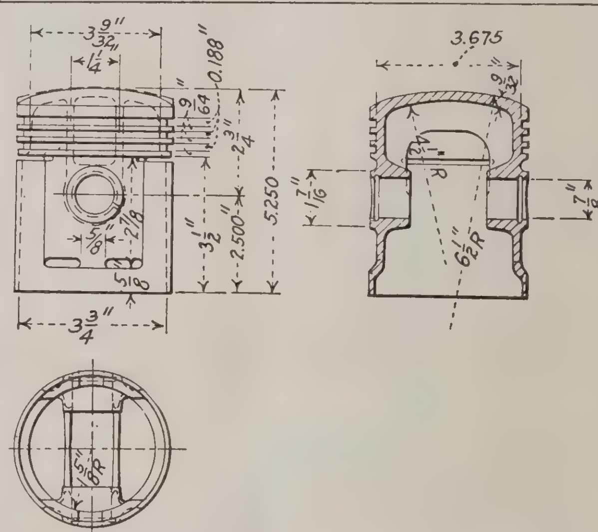


FIG. 8—IN THIS PISTON THE MECHANICAL EXPANSION DUE TO THE HEAD IS TAKEN CARE OF BY RELIEVING THE SIDES

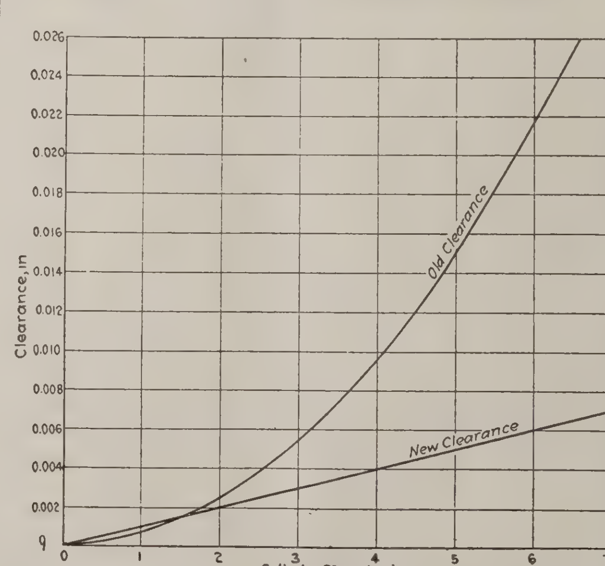


FIG. 9—COMPARISON OF THE CLEARANCE FORMERLY USED ON ALUMINUM PISTONS AND THAT NOW PREVAILING

the expansion of the head would be 0.032. The skirt temperature in this same test was 210 deg. Fahr., a rise of 140 deg. above room temperature. This on a 5-in. piston gives an expansion of 0.0085 in. The mean cylinder-wall temperature is the average between the piston-skirt temperature and the cooling water, that is, 178 deg. Fahr., 108-deg. rise over the room temperature. This would give a cylinder-wall expansion of 0.003 in. The clearance necessary should then be the difference between the piston expansion and the cylinder expansion, which in this case is 0.005 in. This would give us no clearance for an oil film and the piston would seize. Tests which we have made prove that 0.005 in. is enough for a piston of this description running up to 1,600 r.p.m. at which the skirt temperature is undoubtedly somewhat higher than at 800 r.p.m. The clearance which we know is necessary for the piston in less than the temperature would seem to indicate. This can be explained in the following way: The expansion of the head is acting on that portion of the piston skirt which is not separated from the head by slots and is imparting to it a mechanical expansion in addition to the thermal expansion. If a circle is expanded only along one diameter it will have to contract along the diameter at right angles to it, that is, the circle will be changed into an ellipse by shortening one of its axes and lengthening the other. The mechanical expansion along the axis of the wrist pin has been made harmless by either relieving the piston at the ends of the wrist pin or by giving it flexibility by a vertical slot.

Fig. 7 shows a piston which makes use of the flexibility by means of a slot to correct for head expansion. This type is in use in the Maxwell car. Fig. 8 shows a piston in which the head is separated from the skirt on the thrust faces and the mechanical expansion due to the head is taken care of by relieving the sides as shown. This type is in successful operation in Northway engines. In making slots it should not be overlooked that these should be made as wide as possible so as to allow a free passage of the oil back into the crankcase. In providing a relief on the sides this should be of ample depth. Holes of a large size or preferably a short slot at the bottom of the relief should be provided so that oil accumulated in the relief can pass away easily and quickly.

The successful operation of pistons is measured by the minimum clearance necessary for satisfactory performance. The progress of aluminum pistons within the last few months can be shown best by comparing the clearance curves in use now with those in use several months ago. Fig. 9 shows these two curves, both of which are based on experiments. The top curve shows the clearance necessary for pistons of the old conventional type and the lower the clearance necessary for the types just mentioned.

It is, of course, impossible to lay down this curve as a definite law. Engine temperatures undoubtedly depend on engine design and piston temperatures depend upon piston clearance. While these curves were determined from actual practice the characteristics of all engines may not be the same and some variation might be found necessary. The actual clearance required can be determined only by tests in each case, but the clearance on the curve represents a safe starting point for these tests. In the past aluminum pistons have shown certain faults, but present practice indicates that these faults were faults of design and not faults of alloys.

THE ARMY AND NAVY BOMBING TESTS

THE first of the bombing experiments to be conducted by Army and Navy forces jointly with the radio-controlled *Iowa* and with the ex-German warships as targets, is set for Tuesday, June 21, according to a report submitted today to Admiral Wilson, Commander-in-Chief of the Atlantic Fleet, by the board which held a meeting May 11 in the Navy Department.

At this joint meeting of naval officers both from the fleet and from the Department, and officers of the Army Air Service, tentative plans for the tests which will be conducted under the direction of the Commander-in-Chief of the Atlantic Fleet were made.

The first of the tests will be the sinking of one of the captured German submarines. In this, as in the other experiments, the Army and Navy fliers will co-operate.

The next step in the operations will be the searching by aircraft for the *Iowa* in a definite area within a radius of one hundred miles off shore. She will be operated under radio control and after the aircraft locate her she will be bombed by dummy bombs in order to determine the extent of the ability of aircraft to register hits on a moving target. No explosives are to be used on the *Iowa* as she is to be used later as a moving target for the Fleet's big guns.

Next will come the bombing tests with one of the ex-German destroyers as the target. This vessel will be attacked, and, if practicable, sunk by aircraft using 250 pound bombs. The other destroyers will be targets for the guns of our destroyers as will three of the submarines.

Then will come the bombing by the Navy and Army aircraft on the ex-German cruiser *Frankfurt* and ex-German battleship *Ostfriesland*, according to plans previously announced by the Navy Department. All of the ex-German ships are eventually to be sunk if not by bombs or gunfire then by depth charges. The German ships are being destroyed in conformity with the international agreement by which they were obtained. The Navy is taking this means of determining the effect of modern explosives on modern ships.

The test which will be continued on through July are for the purpose of determining the effect of gunfire and aerial bombing on the structure and material of the various vessels to be attacked, as well as for tactical search exercises and tests to determine the accuracy of bombing.

Tests will be made in a series of progressive steps. The vessel will be examined by experts after each step is completed and the tests will be conducted slowly so that the maximum knowlelge of the effect of the explosives will be determined.

An interesting feature will be the test of communications, from aircraft to shore stations, and from aircraft to aircraft, working through radio interference in getting concentration after the scouts have picked up the objective.

"These bombing tests," said Captain Johnson, Commander, Atlantic Fleet Air Force and acting chairman of the Board that met May 11, "are merely a part of the day's work in the routine of the Navy. They will be of no value unless conducted along scientific lines.

"We must know what effect the bombs will have and the number of hits which can be made by aircraft. It is unnecessary to drop 2000 lbs. bombs on a destroyer to sink her if a 250 lbs. bomb will do the work just as well.

"Consequently we will use small bombs on the destroyer and submarine and will determine, after hits are made, how much damage is done and the lessons to be learned from the experiment. It will be the same in the case of the *Frankfurt* and *Ostfriesland*. First, hits will be made by bombs and the effect registered.

"Then will follow attacks on the two ships using larger bombs, up to the largest, each time inspecting the ship to determine the damage done and the efficiency of the bombs themselves. The mere spectacular bombardment of the ships by a large number of bombs will serve no useful purpose, but carefully inspected results will teach us certain points not entirely known respecting the efficiency of bombs and the present methods of armament on the upper decks of large ships.

At the conference the following officers represented the Commander-in-Chief, Atlantic Fleet, Admiral Henry B. Wilson participated: Captain A. W. Johnson, Commander, Air Force, Atlantic Fleet. Capt. T. A. Kurtz, Assistant Chief of Staff, Atlantic Fleet. Commander W. S. McClintic, Ordnance Officer, Atlantic Fleet.

The following represented the Navy Department: Capt. L. A. Bostwick, Office of Naval Operations; Capt. W. C. Watts, Director of Gunnery Operations; Capt. S. H. R. Doyle, Commanding Officer, Naval Air Station, Hampton Roads, Va.; Commander Kenneth Whiting, Aide and representative of Capt. W. A. Moffett, Director of Naval Aviation; Major T. C. Turner, representing the Marine Corps.

The Army Air Service was represented by Brigadier General Wm. Mitchell, Colonel T. D. Milling, Major W. G. Kilner, Major W. C. Sherman, Captain B. S. Wright, and Captain T. H. Douglas.

According to the original announcement made by the Joint Army and Navy Board these bombing experiments are designed to determine:

The ability of aircraft to locate vessels operating in the Coastal Zone and to concentrate on such vessels sufficient bombing aeroplanes to make an effective attack.

The probability of hitting with bombs from aeroplanes, a vessel underway and capable of maneuvering, but incapable of anti-aircraft defense.

The damage to vessels of comparatively recent design which will result from hits with bombs of various types and weights. The vessels to be attacked by bombing are

(*Concluded on page 262*)

FOREIGN TECHNICAL DIGEST

The Passat "Helithopter"

Helicopters, which are very much in the air—literally—just now, are not the only rivals to more orthodox methods in the present field of aeronautical development. M. Passat, who has been experimenting with ornithopters for a considerable number of years, is now at work on a new type of machine, which he aptly calls a "Helithopter"—a sort of crossbreed between a helicopter and an orinthopter. We understand that M. Passat, as a result of his past experiments—which, we may mention, have been recorded in *Flight* on various occasions since 1909—with the latter type of machine, has come to the conclusion that the mechanical difficulties are, at present, against the successful realization of the flapping wing machine. Although he actually got his last ornithopter to lift, he had to abandon further trials owing to the constant mechanical defects which occurred, due to the various strains set up. Nevertheless, he has, he says, obtained much valuable data which are aiding him considerably in his present experiments.

We do not, at present, propose to describe this new "Helithopter" in detail, but will only just briefly refer to the principle employed. When inspecting the experimental machine, which is fitted with a 10 h.p. A.B.C. 2-cyl. engine, and is very roughly and simply designed and constructed—and here we think M. Passat would find it much to his advantage if he reconstructed the machine on improved lines before continuing further experiments—we must admit we were somewhat impressed with the demonstrations given us.

Briefly, the machine consists of four bird-like wings arranged radially on a shaft driven by the engine. A simple—and, we should think, quite a practical—cam arrangement turns each wing, as the whole revolves in such a way that on its down stroke it is in a horizontal position, whilst on the up stroke it "feathers" with its leading edge in the direction of motion. The result is that, according to the angle at which the wing is set, an upward or forward thrust is obtained. In the demonstrations referred to above, when the little A.B.C. was speeded up, the wings pulled the machine—or more strictly speaking, the wooden scaffold on wheels carrying engine and wings—forward with apparent ease.

There appeared to be, also, a distinct tendency to lift in a vertical direction. M. Passat tells us that he obtains a lift of well over 200 lbs. and a forward thrust of 75 lbs. with the 10 h.p. engine. In the full-sized machine it is proposed to provide two or more pairs of wing-units arranged on the port and starboard sides of the body. When all wing-units are working direct vertical lift is obtained, but slowing down the forward ones will cause the nose of the machine to drop, and a forward motion results.

Although M. Passat has many difficulties yet to overcome, he has undoubtedly hit on a very interesting problem, and one that certainly deserves further investigation. We shall watch future developments closely, and hope presently to give our readers further particulars.—*Flight*, April 21, 1921.

Meteorology in the Service of Aviation

Meteorology should be of service to aviation: (I) By providing necessary information regarding all weather conditions which are likely to be encountered on any journey; (II) by providing statistical information which may be required to settle certain definite questions and by explaining the physical causes of various phenomena.

Part I. Daily Weather Services may be divided into four parts, according to the information which is required by an aeroplane starting out on a long journey.

(1) Probable wind at any height along the route.

(2) Heights of the upper or lower limits of the various cloud layers.

(3) Ample warning must be given of any possibility of the clouds becoming so low as to touch the ground at any point along the route, or the formation of a ground fog.

(4) General weather along the route, with particular warning of any squalls, etc.

A few observing stations will suffice at first along the most frequented routes. The necessary observations are: (1) Wind velocity and direction at all heights; (2) heights of the upper and lower limits of cloud layers; and (3) the temperature, pressure and humidity are also desirable. The most economical method of observation is by using unmanned kite balloons carrying recording instruments. They have already been tried for this purpose, and suitable recording instruments are in being.

Reference is also made to the possibility of clearing small areas of fog artificially when aircraft wish to land. The various proposals for doing this have been attracting considerable attention lately, and are as follows: (1) *Artificial Warming* of the air by burning coal, having a number of small portable furnaces, which could be arranged in a row. (2) *Artificial Drying* by blowing into the air a substance like powdered calcium chloride. (3) *Electric Discharge.* This method is hardly practicable on a large scale.

Part II. Statistical Information. Much of this information, especially that applying to the atmosphere near the ground, is already available, and the remainder can nearly always be obtained if it be considered of sufficient importance to spend the necessary amount of money in obtaining it. (Major G. Dobson, Paper read before the Royal Aeronautical Society, Feb. 3, 1921.)

Sablatnig Types

This article gives a historical review of the work that has been done by Dr. Sablatnig and describes in a general way his latest commercial product, the "Sabi P-3." This machine is a monoplane, capable of carrying comfortably six passengers. The wings can be folded, so that it can be housed in an ordinary garage, and its chief feature is the facility with which it can be either assembled or dismantled. The spread of the wings, when fixed, is 52 feet; its total length is 27 feet and its greatest height 10 feet 6 inches. It is fitted with a 260 H.P. Maybach, driving a tractor propeller, and carries petrol for a flight of 4½ hours. For winter flying it can be fitted with snow runners, which are 6 feet 6 inches long and project forward from the body. They are flat and turned up at the point, being designed on lines borrowed from the ski, though they are wider, stronger and longer. The comfort of the passengers has been carefully attended to, the cabin being fixed with a special heat regulator. (*Der Luftweg*, January, 1921.)

Theory of Propulsive Screws, Marine and Aero

A brief analysis of work presented by the author to the Academy of Sciences.

The first part of the work relating to screws for both water and air is almost entirely new, founded on the hypothesis and ideas which were expressed in previous communications. The present theory is more comprehensive.

The theory introduces first as a variable fundamental the true reaction σ, in relation to the actual pitch, which is the advance for revolution of a screw with no thrust, and the section of the column of fluid attacked by the screw is divided into two principal zones. The first central zone is designated the total action, the second annular zone is designated the partial action. The distinction of the two zones is based on the coefficient of influence K, which has a value about 2, and seems greater for air than for water. With air screws of the usual form the action is entirely partial, but this approximation does not conform exactly with experiments. To be more exact it is necessary to have two other zones, one between the two zones specified above, and the other due to the marginal effect.

The author gives six formulæ, of which the first is as follows:

The thrust of a screw is given in kilogrammes by the relation $F = b\,\omega\,n^2\,(\sigma - e^1\,\sigma^2)$, where ω is the specific weight of the fluid in which the screw is revolving in kg. per cubic metre, n the number of revolutions per second, σ the reaction in relation to the actual pitch, and e^1 coefficient, generally small, which varies with the ratio P of the actual pitch to the diameter, and its value is in the neighborhood of

$$\frac{P^2}{2.5\,P^2 + \pi^2}$$

Other formulæ are given for the resistance of the screw, the efficiency of the screw under varying conditions of slip stream resistance, and for varying numbers of blades. (A. Rateau, *L'Aeronautique*, Feb., 1921. 1¼ pp.)

The Berkel Naval Monoplane

This is a twin-float machine, equipped with a Rolls-Royce Eagle VIII. engine, designed for use in the Dutch East Indies. The wings, of the semi-cantilever type, are attached to the lower longerons of the fuselage and supported midway along their span by struts sloping outwards from the floats. The fuselage, control surfaces and floats are very similar in general appearance to those of the Brandenburg type seaplanes manufactured by Van Berkel during the war. A top speed of 112 m.p.h. and a duration of 940 miles flight are claimed. The machine carries a full military equipment, including two machine-guns firing through the propeller and a third on a gun-ring in the rear cockpit.—(*Het Vliegveld, March* 26, 1921.)

NAVAL and MILITARY AERONAUTICS

U. S. Flyers Decorated

Warsaw.—Ten Americans who fought in the World War and then came to Poland to fight against the Bolsheviki were honored May 10 by President Pilsudski and Gen. Joseph Haller at ceremonies attending the demobilization of the famous Kosciusko Aerial Squadron, composed of young aviators from the United States.

President Pilsudski, in his residence, Belvedere Palace, decorated Lieut.-Col. Cedric E. Fauntleroy of Chicago, Lieut.-Col. Merion Cooper of Jacksonville, Fla.; Major George M. Crawford of Wilmington, Del.; Capt. Edward J. Corsi of Brooklyn, and First Lieut. Elliott Chess of Texas with the Cross of the Brave.

Afterward President Pilsudski entertained the members of the sqaudron at luncheon. Gen. Haller later awarded the Polish service medal to all ten members of the squadron, whom he thanked for their services in aid of Poland.

The E. D. 1,000 Horse-power Engine

The Engineering Division, McCook Field, has completed preliminary design of a 1000 h.p. 18-cylinder engine. This preliminary work indicates that such an engine can be constructed on conservative lines and may be expected to give an excellent power to weight ratio, at the same time maintaining a very conservative loading of all vital parts, thus insuring great dependability and long life.

The design is being further developed on the basis of 1000 h.p. at 1400 r.p.m. direct drive, this speed insuring great reliability and being favorable to high propeller efficiency in connection with a large power output.

A cylinder of the proposed design has been constructed and tested with very satisfactory results. This cylinder has a bore of 6½ inches with a 7½-inch stroke. It is of the 4-valve type with welded steel jackets. Dynamometer tests of the single cylinder indicate that the 18-cylinder unit may reasonably be expected to develop 1000 h.p. at 1400 r.p.m., with a very satisfactory fuel consumption. The cylinders are arranged to accommodate 4 spark plugs per cylinder, which has some advantage from the point of view of power output and economy. Furthermore, it is planned to use four independent magnetos, thus securing the utmost reliability through the use of four entirely independent ignition systems.

Report of Changes of Stations of Officers for Week Ending May 3

April 27, 1921—First Lieutenant Max F. Moyer, Air Service, ordered from Langley Field, Hampton, Virginia, to Aberdeen, Maryland, for duty with Air Service Troops.

April 27, 1921—First Lieutenant Hugh C. Minter, Air Service, ordered from Chanute Field, Rantoul, Ill., to Mather Field, Sacramento, Cal., for duty.

April 28, 1921—First Lieutenant John K. Cannon, Inf., detailed to Air Service, relieved from duty at Columbus, New Mexico, and ordered to Carlstrom Field, Arcadia, Fla., for pilot training.

April 28, 1921—First Lieutenant Joseph W. Benson, Air Service, ordered from Ross Field, Arcadia, Cal., to Camp Knox, Kentucky, for duty with 31st Balloon Company.

April 28, 1921—First Lieutenant Dache M. Reeves, Air Service, ordered from Ross Field, Arcadia, Cal., to Army Balloon School, Lee Hall, Virginia, for duty.

April 28, 1921 — Captain William E. Kepner, Air Service, ordered from Ross Field, to Camp Benning, Georgia, for duty with the 32nd Balloon Company.

April 28, 1921—Major Arthur R. Christie, Air Service, relieved from duty as Commanding Officer, Mitchel Field, Long Island, New York, and directed to report to Director of Military Intelligence, General Staff, Washington, D. C., on temporary duty; thence to Tokyo, Japan, reporting to Military Attache, American Embassy, for duty.

April 28, 1921—First Lieutenant John P. Temple relieved from further duty at Godman Field, Kentucky, and ordered to Ross Field, Arcadia, Cal., for lighter-than-air training.

April 29, 1921—First Lieutenant James H. Howe relieved from duty with Air Service at Carlstrom Field and returned to duty with the Infantry.

April 29, 1921 — Captain Chilion F. Wheeler, Air Service, relieved from further duty in Supply Group Office, Chief of Air Service, and ordered to McCook Field, Dayton, Ohio, for duty.

April 29, 1921—Following Air Service officers from March Field, Riverside, Cal., to Mather Field, Sacramento, Cal., for duty: 1st Lieuts. Alfred E. Waller, George A. McHenry, Faye S. Gullert, Robert S. Worthington, Eugene B. Bayley, Benjamin S. Catlin.

April 29, 1921—Major Thomas J. Hanley, Jr., Air Service, who has been on duty as student at the Field Officers' School, Langley Field, Hampton, Va., has been assigned to duty as instructor at that school.

April 29, 1921—Captain Truman W. Allen, Air Service, relieved from duty in Supply Group, Office Chief of Air Service, and ordered to Mitchel Field, Long Island, New York, for duty.

April 29, 1921—First Lieutenant Junius A. Smith, Air Service, ordered from Lee Hall, Virginia, to Langley Field, Hampton, Va., for course of instruction at the Airship School.

If this should meet the eye of Capt. W. Beaver, M.C., late of 62 Squadron and 21st Wing R.F.C., will he please communicate with Lieut. Colonel G. L. P. Henderson, M.C., A.F.C., 6, Cambridge Square, Hyde Park, London W.2. Any other members of that Squadron and Wing are also invited to communicate with Colonel Henderson who is now in London.

Office force of Naval Aviation, March 4, 1921. This group contains the incoming and outgoing Directors of Naval Aviation and the officers and clerks detailed to Naval Operations, and the various Bureaus having cognizance of aviation matters. Front row, left to right: Lt.-Comdr. E. D. Stanley (S.C.); Major T. C. Turner, U. S. M. C.; Lt.-Comdr. J. P. Norfleet, Comdr. E. G. Allen, Comdr. V. C. Coman, Comdr. R. M. Griswold, Capt. W. A. Moffett (incoming Director of Naval Aviation); Capt. T. T. Craven (outgoing Director of Naval Aviation); Comdr. W. J. Giles, Comdr. K. Whiting, Comdr. C. T. Jewell, Lt.-Comdr. P. N. L. Bellinger, Lt.-Comdr. Z. Lansdowne. Second row, left to right: Miss Catherine Turner, Miss Rachel Parham, Miss Mary Farington, Mrs. Lucille H. Henderson, Capt. Robert K. Williams, U. S. M. C.; Lt.-Comdr. R. A. Burg, Lt.-Comdr. S. M. Kraus, Comdr. J. C. Hunsaker; Lt.-Comdr. G. deC. Chevalier, Lt.-Comdr. W. Capehart, Lt.-Comdr. G. Fulton, Lt.-Comdr. R. M. Hinckley, Lieut. G. W. Kirkman, U. S. M. C.; Miss Betty Baker, Miss Gertrude Baker, Miss Hazel McKercher. Third row, left to right: Lieut. W. L. Richardson, Lieut. J. J. McAtee, Lieut. G. R. Rankin, Lieut. C. A. Tinker, Lieut.-Comdr. B. G. Leighton, Lieut. K. B. Bragg, Lt.-Comdr. R. E. Byrd, Jr., Lieut. C. E. Keiser, Lt.-Comdr. T. C. Gibbs, Chief Clerk Lane Lacy

FOREIGN NEWS

The Monaco Meeting

Whilst at last year's Monaco competitions Italy was represented by the two firms Macchi and S.I.A.I., this year only S.I.A.I. machines have been enlisted for the contest.

The S.I.A.I. seaplanes that will take part at the Monaco competitions are three:—

1—Type S12, fitted with Ansaldo-St. Giorgio engine 4E.284 450 h.p., the same type as took part in last year's contest.

2—S.21 seaplane, fitted with a new Isotta-Fraschini V.9 310 h.p. engine, a very fast machine—260 km. per hour—designed specially for speed records. The span of its lower wing is greater than of its upper one.

Span of wings	7.70 metres
Length	7.60 "
Height	2.95 "
Total weight	900 kg.
Useful load	200 kg.

3—Type S.22, fitted with two 260 h.p. V.6 Isotta-Fraschini engines, placed tandem. It is believed that this machine will have a speed of more than 220 km. per hour.

Span	13.50 metres
Length	10.80 "
Height	3.50 "
Total weight	2,500 kg.
Useful load	800 kg.

Paris Aero Salon in November

Either the first or last fortnight in November next will be the period for holding the Paris Aero Salon. The exact date rests with a Chambre Syndicate Committee appointed for the purpose, and meeting early in May. That month it is claimed will be preferable to December as it renders more easy the combination of the Grand Palais exhibits with aerodrome demonstrations. It is hoped next year to go one better in this respect, by holding the 1922 salon earlier, with even July as a possible date.

A Helicopter Prize

M. Soreau, President of the Ae.C. of France, last week announced the offer by the Club of a prize of 25,000 francs for the first helicopter which shall rise 25 metres vertically through an imaginary cylinder, descending again to the starting spot. At the moment the offer may seem somewhat empty, but if we accept the views of some of those who are engaged upon this special problem, it should not be overlong before the Club is called upon to pay over the 25,000 francs. We sincerely trust the Club may have that pleasure and great honor.

Italy Increases its Aviation Vote

The Italian Minister of War has been successful in obtaining a substantial increase to the 17 million lire already voted for aeronautical purposes, amounting to about 30 million lire. The firms still engaged in the production of aircraft are to receive 1 million lire each for delivery of machines and as a subsidy towards research and experiments. These firms are: Ansaldo, Fiat, Savoia, Macchi and Breda.

Aeronautics in Honduras

For the first time in the history of Honduras an aeroplane flew over this mountainous Central American country. As a matter of fact it is the first aeroplane that flies in Central America from one city to another, for although a Mexican machine has been in the Republic of Salvador for the last three years, and some aeroplanes have for some time past been introduced in Guatemala and Costa Rica, their flights have been limited to short exhibits over the respective capitals, but never have they flown from one city to another.

Mario Ribas de Cantruy, editor of "Renacimiento" and member of the World's Board of Aeronautical Commissioners, who is doing constructive aeronautic work in Honduras

This new feat has been accomplished today, 19th April, 1921, when a Bristol machine flew from San Pedro Sula on the north coast of Honduras to Tegucigalpa, the capital of the Republic. The distance is 216 miles and it was covered in 84 minutes.

The machine was piloted by the Canadian aviator Ivan Dean Lamb, and reached a height of 18,000 feet, passing over some of the highest mountains in Honduras through a very dense fog which at times made flying exceedingly difficult.

Some of the Indians living in the mountains received the scare of their life when, for the first time, they saw that big "bird" cut the air at such a terrific speed. As the day before a rather strong earthquake had been felt, some of the natives thought the "bird" was some ill omen that was bringing the wrath of the elements over the country.

This first aeroplane will be for the present attached to the War Department, but as soon as another machine is brought over, both will be used, in peace times for carrying mails from coast to coast. Let it be said that this distance of 216 miles covered by the "Bristol" in 84 minutes is usually covered in FIVE days by motor car from Tegucigalpa to Comayagua, by mule from Comayagua to Lake Yojoa, by launch across the lake, thence again by mule to Potrerillos, and finally from Potrerillos by train to San Pedro Sula. The usefulness of an aeroplane service is therefore readily understood when comparing the time saved by using the air route.

Both President López Gutierrez, and the Minister of War General Carlos Lagos have been great enthusiasts of aviation, and this day has marked a great moment in the history of Honduras.

We may say also that the monthly review "Renacimiento" and its Editor, (Mario Ribas de Cantruy, member of the World's Board of Aeronautical Commissioners) have done their best during the last few years to awaken interest in Honduras in aviation matters.

The enthusiasm aroused by this first aeroplane successfully flying across country, is such that aviation is every moment winning friends in Central America, and there is talk already of a flight from Guatemala to Panama over the five Central American countries and through the Andine cordillera.

Danish Aerial Lighthouse

At the aviation ground near Copenhagen there has been erected the first aerial lighthouse in Denmark. It is not very high, the signals only being visible from above, but the intermittent light signals indicating the location of Copenhagen are powerful enough to be seen several hundred metres above the ground level. The lighthouse has not yet commenced regular working, but its erection is regarded as an important step in the development of international aerial communications.

The Gordon Bennett

The Aero Clubs of Spain and Switzerland are sending entries to the race in Belgium in September for the Gordon Bennett Cup.

Rotterdam Aerodrome

An aerodrome has been established in Rotterdam at the city's expense to accommodate the London-Amsterdam, Amsterdam-Brussels-Paris, and Rotterdam-Hamburg services. The Dutch Minister for Water Works has announced that his Government is opposed to the Air Convention, but is willing to make separate agreements with the various powers.

Palestine to Baghdad

Colonel Lawrence and Peake Bey have discovered by aerial reconnaissances two usable tracks, from Trans-Jordania to Baghdad, which may prove to be of the greatest importance.

Civil Aviation in Sweden

It is probable that the air mail service between Malmo, Copenhagen, Warnemunde, Berlin, and between Malmo, Copenhagen, Hamburg, Amsterdam and London, which was run last autumn by the Swedish Air Traffic Co., will be re-opened during the coming spring.

Proposals are being considered for establishing a commercial airship service from Stockholm to either London, Paris, Geneva, Berlin or Vienna. The journey from Stockholm to London is calculated to take about 16 hours, and the cost per passenger is provisionally estimated at about Kr. 750.

"Dutch Week" to be Held in Madrid in May

The Netherlands Chamber of Commerce has announced that a "Dutch Week" is to be held in Madrid in May, for the purpose of fostering good relations between Holland and Spain. It is said that the Netherlands Government will send a squadron of military Fokker aeroplanes to assist in the demonstrations. It is also stated that the Netherlands Aircraft Company may send several Fokker Commercial aeroplanes in order to arouse interest in air transport with the Spanish authorities, especially the postal department. The machines are of the type now carrying mails between Holland and England, Germany and Denmark.

Japan Receives Part of German Aircraft

One Zeppelin airship for the navy, and about 30 aeroplanes, constituting a part of Japan's share of the German machines either captured or turned over to the Allies, have reached Yokohama, according to press reports.

A Good Showing in France

At a recent banquet of the Aero Club of France, M. Flandin, Under-Secretary of State for Aeronautics, furnished the following interesting details of the record of French aviation.

He said that in 1920 there had been 1,500,000 kilometres flown, as against 350,000 in 1919.

In the course of these voyages there had been only one fatal accident for every 215,000 miles flown.

In 1920 there had been 6,750 passengers transported, as against 960 in 1919. In 1920 there had been 103,360 kilos of freight transported as against 13,980 kilos in 1919.

The statistics gave 5,210 kilos of letters carried in 1920, while in 1919 the amount had been 466 kilos.

There were at the moment 275 aeroplanes in operation for public service, and 79 privately owned machines operated for individual use.

ELEMENTARY AERONAUTICS *and* MODEL NOTES

CLUBS

PACIFIC MODEL AERO CLUB
240 11th Avenue, San Francisco, Cal.
Portland Chapter: c/o J. Clark,
Hotel Nortonia, Portland, Ore.

PACIFIC N. W. MODEL AERO CLUB
921 Ravenna Blvd., Seattle, Wash.

INDIANA UNIV. AERO SCIENCE CLUB
Bloomington, Indiana

BROADWAY MODEL AERO CLUB
931 North Broadway, Baltimore, Md.

PASADENA ELEM. AERONAUTICS CLUB
Pasadena High School, Pasadena, Cal.

NEBRASKA MODEL AERO CLUB
Lincoln, Nebraska

BUFFALO AERO SCIENCE CLUB
c/o C. Weyand, 48 Dodge St., Buffalo, N. Y.

ILLINOIS MODEL AERO CLUB
Room 130, Auditorium Hotel, Chicago, Ill.

SCOUT MODEL AERO CLUB
304 Chamber of Commerce Bldg.,
Indianapolis, Indiana

MILWAUKEE MODEL AERO CLUB
455 Murray Ave., Milwaukee, Wis.

MODEL AERO CLUB OF OXFORD
Oxford, Pa.

CAPITOL MODEL AERO CLUB
1726 M St., N. W., Washington, D. C.

AERO SCIENCE CLUB OF AMERICA
Beach Bldg., E. 23rd St., New York City

AERO CLUB OF LANE TECH. H. S.
Sedgwick & Division Sts., Chicago, Ill.

LITTLE ROCK MODEL AERO CLUB
1813 W. 7th St., Little Rock, Ark.

Model Float Construction

(*Continued from May* 16, 1921 *issue, page* 233)

WHEN three floats are used, it is customary practice to place two floats forward and one aft. This distribution is the simplest manner of obtaining longitudinal or fore-and-aft stability and transverse or lateral stability. The forward floats must be placed well ahead of the center of gravity of the model or else there is liability of the machine pitching over when taking off or more likely when alighting. The rear float should be arranged to take off first for as the tail end of the plane gets off the angle of the wings are lessened and more air speed is possible. If the two front floats are placed too far ahead of the center of gravity, too much weight will rest on the rear float and a longer time will elapse before it gets clear of the water.

The proper spacing between the two front pontoons is determined by the span of the wings and their height from the water. Weight considerations make a close spacing desirable but this should not be carried too far or a tendency to tip over on the wing ends will be present.

So far, consideration has been given only to the buoyancy and placement of the floats, but there are other problems which require study, namely; shape of hull, construction and method of attachment to the model.

Hull Shapes

There are two important factors which must be considered in designing the outline of a hull. The more important one is the outline of that part of the hull which comes in contact with the water and the other consideration is the shape of the whole mass as it moves through the air. The first condition requires a shape which will permit the machine to rise quickly and which will stand up properly when return is made to the water.

A float with a flat bottom lifts to the surface quickly but has a tendency to skim along sidewise in responce to a contrary wind. Pontoons with a slightly V bottom give much better results, for they both keep a true course when getting off as well as assist in taking up the shock in alighting. In alighting with a flat bottom pontoon the impact is received over a wide area of the bottom and consequently the racking effect is much more pronounced. The V bottom, on the other hand, enters the water gradually, eliminating a good deal of the shock.

When a pontoon glides to the top of the water usually a vacuum is present at the point touching the water, and on this account it is customary to supply air to this portion of the pontoon by means of vent tubes. In model work, however, there is rarely any necessity for this practice.

In order that the machine be in equilibrium when leaving the water, the most advantageous location for the end of the pontoon would be below its center of gravity. In long pontoons it is necessary to provide a "step" near the center of gravity which really is the last point to leave the water in ascending. This "step" acts as an artificial termination of the float.

For ease of construction many floats are of square section but those designed with a realization of their resistance through the air are streamline in shape in so far as they do not interfer with the nautical requirements.

Construction

Most full sized hydroaeroplane floats are built of veneer or ply wood. Other materials used are laminated balsa and fibre, aluminum and even galvanized iron. Metal floats are not regarded as staisfactory because of their tendency to rust in any kind of water and to corrode in salt water.

Serviceable floats or boat hulls for model hydroaeroplanes and flying boats may be made very simply with light stiff cardboard. The material should be similar to that used in government post-cards; that is, thin and with a hard surface. Some experiments along this line led to surprisingly good results, and further development is suggested.

Pontoons have been built with balsa wood giving very satisfactory service. One form of pontoon which worked very well had its sides of balsa with light ribs running through one side to the other over which silk was stretched. After coating with shellac this type of pontoon is both light and watertight. Very thin veneer is a good material for pontoon building. Diaphragms or bulkheads running from one side of the pontoon to the other and dividing it into compartments is a practice followed in full sized floats which can well be followed in model work.

Method of Attachment

The type of model will determine largely the best system to employ in attaching pontoons. Struts made of split bamboo are the most common. Other strut materials which have met with favor are light steel piano wire, flat steel wire (such as is used in magazine binding), aluminum wire, etc. All the above materials have enough springiness to require no other shock absorbing medium, and therefore pontoons can be rigidly attached to them.

One of the difficult features of pontoon attachment is to leave a satisfactory connection between the pontoons and the struts. One very desirable method is to make floats which can be removed. This is best accomplished by running two tubes through the pontoons, into which the ends of the struts may be inserted. This means that the tubes are to be run from one side of the pontoon to the other and the ends of the struts bent around parallel to the water and at right angles to the line of flight. Tubes may be of aluminum or of paper. Paper tubes are made by wrapping a narrow strip of paper spirally around a thin wire, at the same time applying a liberal quantity of water-proof cement to all the outside surfaces during the entire wrapping process. When removed from the wire and allowed to dry, the tube will be found to be stiff enough for insertion into the pontoon where it can be finally cemented in place.

When it is not desired to pierce the pontoon with tubes another method of attachment is possible by building struts into the pontoon which project slightly from the sides near the top. From these projections it is possible to make attachment by means of rubber elastic to horizontal struts on the landing gear which are similar to the axles used on land machines.

Pacific Northwest Model Aero Club Still Active

Contrary to a report published on April 25, the Pacific Northwest Model Aero Club is still active. Mr. Robert La Tour, President of the Club, has conveyed to AERIAL AGE information that his organization has always been a "flying" club; all work taking place out of doors. Inasmuch as the winters are far from being ideal in that section of the country it is natural that during periods of uncertain weather activity must temporarily be curtailed, but, as Mr. La Tour expresses it, "The 'flies' still gather at 921 Ravena Boulevard, Seattle, Wash."

Airways

Highway and byway, dusty and muddy,
  Used alike by youth and old age.
Alleyway, pathway, rough and forbidding,
Spilling and losing our booze in their rage.

But, oh! the smooth airways, kind guiding stairways,
  Gentle, soft airways, safe passage for rye.

Subway and railway, dark, damp and dismal,
  Full of upholders of drastic reform;
Streamway and seaway, the "Anti's" complaining,
  Rising in threatening, menacing form.

But, oh! the great airways, unwearying stairways,
  Their soft resilient bosoms mean safety for rye.

Trolley and tramway, clanging, mechanical,
  Full of the "Agents", their nose in the dust;
Creek and canalways, apparently deserted,
  But full of "Plain-clohes", unworthy of trust.

But, oh! the long airways, the roomy, long stairways,
  Mean safe transportation for bourbon, for rye.

STEPHEN G. EVANS.

A certain young pilot of Pinner,
Got gradually thinner and thinner,
Till at last (it was rummy)
There was not enough "tummy"
To effectually streamline his dinner.

Said a pupil unto his instructor,
"I want to become a constructor."
  Said the other, "My boy,
  I don't wish to annoy,
What's more in your line is destructor."

Try Anything Once!

By some misunderstanding, a now famous film producer, Mr. Selig, understood that one of his actors was an aviator. With the showman's impulse, he had a scenario written, the climax of which was an elopement in an aeroplane. Kathleen Williams was slated for the lead. After several thousand feet of film had been "shot" at great expense, the aeroplane was ready, the actor aviator (?) willing, Miss Williams, about to take her seat, inquired: "How did you become an aviator without my knowing it, Mr. Keen?" "Oh, I haven't been up before, but I'll do the best I can," replied K. K. K. K.

Calling on a Motor Manufacturer

On Octember 87th, 1919, we took the train to Powerhorse, N. Y., to interview the designer of that great motor, the Rabid Radial Rotary. We had been warned that he was an exceedingly hard man to interview, very modest for one of such genius. However, we have never failed in an interview yet, so we decided to take a chance. To make a long story a little longer and to fill up space we will proceed. We arrived at Powerhorse, and immediately went to the Rabid Rotary Factory. One could see it from a great distance, and hear the throbbing hum of the workmen chewing gum, mingled with the sound of the rest drinking soup at their noon lunch hour. We approached the factory, opened the door, entered, and were promptly thrown out by the watchman. However, upon explaining our purpose he apologized and let us in. We gave our card to a man standing there and directed him to take it to Mr. I. M. Boranstroke, the inventor of the engine. He hurried away, and came back in a half hour. (The factory was so large that it took two men a half hour to walk its length. Question for mathematical readers: How long would it take three men, and why?)

We were ushered into Mr. Boranstroke's presence, and took a chair. (And a cigar from the humidor by the table.) We decided that we would open the conversation, and wishing to make a particularly apt remark, we said, "Well, sir, nice weather we're having."

The famous man looked out of the window and said: "My motor is the most wonderful that has ever been devised. In fact, it beats a lot of motors that have only been imagined."

Ah, now I had him started!

"Mr. Boranstroke," I parried, "would you mind telling me something about your motor and what your plans are for its marketing?"

The great man paused, mopped his brow, and breathed heavily. We could see that he was undergoing some very tremendous emotion, and that his reply would be of great importance to the motor world in general. Finally he opened his mouth.

"Yes," he gasped.

"Ah, you will tell me," I returned.

"You asked me would I *mind* telling you," he said, "and the answer is *'yes.'* Luke!"

And they threw me out in the cold, cold night.

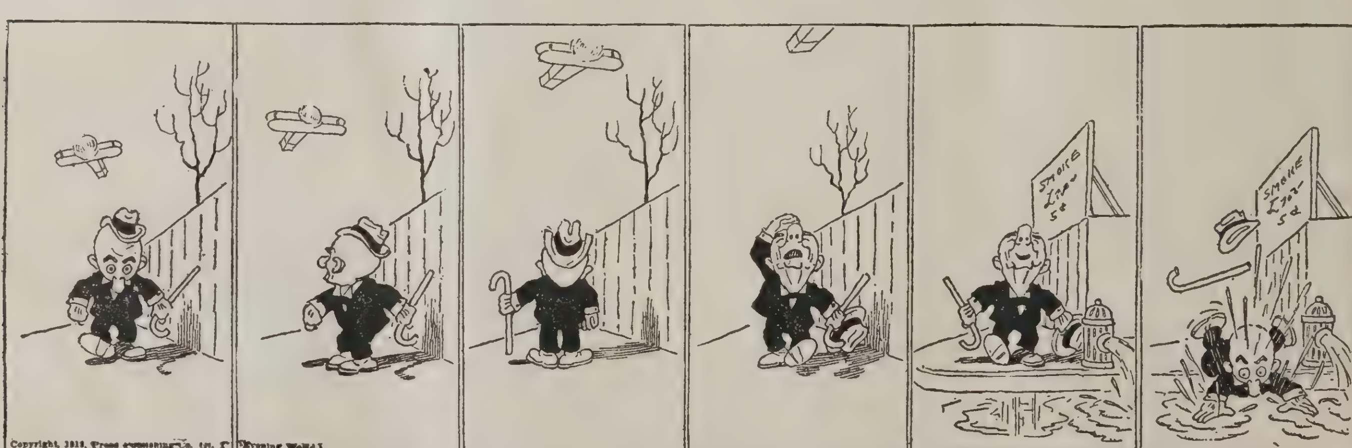
But the report which was handed in to the boss follows:

"When interviewed by our rising young reporter, Mr. I. M. Boranstroke gave out the following specification of his motor:

Pistons. Twelve.
Cylinders. Ditto.
Bore. 48 calibre.
Stroke. 35 a minute.
Revolutions. See Russian History.
Weight. Quite light.
Price. Never sold one.

Wow!

She stood on the hill at midday,
  We sat in the vale with a grin,
For the sun was just o'er the hilltop
  And the dress she wore was thin!



He'd better have been watching for submarines

READY TO STUNT!

Before leaving with the Ruth Law Flying Circus Lieut. Verne Treat put our Canucks through the most exhaustive acrobatic tests. You may not want to stunt but you can rest assured that your *De Luxe* plane is tuned to the highest pitch of efficiency.

SPECIAL THIS WEEK!

New Canuck, painted in light blue and ivory, rebuilt OX5 motor. Assortment of $300 worth of spares, including wing........$2500

DE LUXE AIR SERVICE, Inc.
Asbury Park, N. J.

New OX-5 Curtiss Motors

We have available for immediate delivery a few OX-5 Curtiss, Hammondsport Production Motors, complete with tools and packed in water proof cases.

ESCH & HAMMOND, Distributors of the Laird "Swallow"
2216 So. Michigan Avenue, Chicago, Ill.

PRICE REDUCTION

— on —

New and Rebuilt JN4D, Canuck, F Boat, OX and K-6 Motors, Spare Parts

immediate delivery

CURTISS EASTERN AIRPLANE CORP.
130 So. Fifteenth St. Philadelphia, Pa.

"Airplane Supplies"

NATIONAL AEROPLANE COMPANY
549 W. Washington St. CHICAGO, ILL.

REDUCTIONS IN

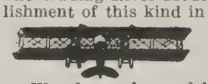
NEW CANUCK & OX-5 ENGINE SPARE PARTS

New Rome Turney Rads. $23—C. A. L. & Paragon Props $20, etc.
Also a complete assortment of
3½% nickel steel bolts, screws, clevis pins, eyebolts, nuts, ferrules, thimbles, turnbuckles, wire and cable.
Write for our 1921 price list.

AIRCRAFT MATERIALS AND EQUIPMENT CORP.
1407-9 Sedgwick Ave. New York City

Students of Aviation, Model Builders and Experimenters

The Wading River Model Airplane & Supply Co., as the oldest establishment of this kind in the U. S., is able to supply you with the best material at the most reasonable prices.



Scale Drawings and Blueprints of some of the latest types always on hand.

We also make models to your own plans at reasonable prices. Send $.05 for Illustrated Catalog.

WADING RIVER MFG. CO., 672 Broadway, Brooklyn, N. Y.

MACWHYTE STREAMLINE

WIRE TIE RODS

STRONGER—LIGHTER

Ten Per Cent Greater Speed

Made in accordance with U. S. Army and Navy Specifications
For Full Particulars Write

Macwhyte Company Kenosha, Wisc.

POSITIONS FOR COMPETENT PILOTS, MECHANICS, ETC. COMPETENT PERSONNEL FOR AEROPLANE OPERATION.

WRITE FOR APPLICATIONS AND FOR DETAILS.

AERO SERVICE COMPANY
1819 BROADWAY NEW YORK CITY.

Advertising in this department 10c a word $2.00 minimum

Classified Advertising

Forms close for this department on Monday preceding date of issue

---

PATENTS **Ex-Pilot U. S. Air Service**
ALLEN E. PECK
Patent Attorney
Pacific Bldg., Washington, D. C.

ATTENTION — AVIATION ENTHUSIASTS. Build your own planes. We are offering at nominal prices, brand new Penguin aeroplanes, without motor. These can be redesigned into ideal sport planes at small costs. Address Haug's Independent Airplane Co., 1007 F. & M. Bank Building, Ft. Worth, Texas.

WANTED—Complete set of exterior including control Canuck wires. Berling magneto with drive assembly. Tachometer drive complete with plate covering timing gear. Address U. W. Cunningham, Orlando. Florida, P. O. Box 161.

EXTRAORDINARY BARGAIN—SEAPLANE—Burgess-Dunne, 3-passenger, with 150-horsepower Isotta engine. Would sell either plane or motor separately. Full particulars of N. H. Smith, 56 Summer St., Boston, Mass.

POSITION WANTED—Aeroplanes—Original inventor and designer of the Gotha Bombing Planes desires position with reliable aeroplane manufacturer. I am a Swiss and have had years of experience with Bristol Co., in England, Bleriot in France. Gotha in Germany. Address Gotha, Box 588, c/o Aerial Age Weekly, 280 Madison Ave., New York City.

FOR SALE—Canuck and JN4D plane parts at sacrifice prices for quick sale including wings, ailerons, elevators, center sections, rudders, wheels, etc. All in A-1 shape. Our special offers this week: Wings (uncovered) $50.00 each. Full set with ailerons $225.00 each. Rebuilt Canucks sold at bargains. Haug's Independent Airplane Co., 1007 F. & M. Building, Ft. Worth, Texas.

ONE CURTISS JN4D in excellent condition, newly covered last season. Motor just overhauled $1500. One Standard V2, three seater, plane has about forty hours flying. Will offer the Standard V2, 200-horse power, three-seater and 4 V2, motors, 2 radiators, for three thousand dollars. We want a buyer. Address Ernest Mason, New Albany, Ind.

EXPERIENCED MECHANICIAN; former Air Service engineering officer, desires connection with progressive company or individual; reliable and trustworthy, five years' experience, excellent references. Address Box 589, c/o Aerial Age Weekly, 280 Madison Ave., New York City.

PILOT also doing parachute work, double and single drops, wishes to hear from reliable company. Address Register, 601 Bridge St., Grand Rapids, Mich.

FOR SALE—New Liberty motor parts, reasonable price, immediate shipment. Also brand new Curtiss OX5 cylinders. Never uncrated. Address Grant Motor Co., 912 E. Grand Blvd., Detroit, Mich.

PILOT with five years' experience wants position flying Saturdays and Sundays within commuting distance New York. Carried passengers last summer. Fly on commission. Address Walter J. Shaffer, Y. M. C. A., 1125 Bedford Ave., Brooklyn, N.Y.

WANTED, two Standard J1 fuselages, also one JN4D fuselage. Address Harry B. Crewdson, Great Northern Hotel, Hot Springs, Ark.

WANTED—One Roberts two cycle motor. State number of cylinders, horse power, R.P.M., bore and stroke. Must be in running condition. Address A. E Schuh, 1934 Elmwood Ave, Buffalo, N. Y.

CAMERAS—One K-1 18 x 24 cm, Eastman Automatic air film camera fitted with 20 inch F.6 Hawk Eye Lens including wind motor with Venturi Tube. Price $750.00. One A-1 4 x 5 Eastman Hand Hold Camera with 10 inch F 4 x 5 Hawk Eye Aerial Lens and Graflex Plate Holder with six magazine plate holders. Price $250.00. The above cameras are brand new and in excellent condition. For anyone expecting to do photographic work, it will save over $500.00. Address Curtiss Eastern Airplane Corp., 130 S. Fifteenth St., Philadelphia, Pa.

WANTED—Two or four Dixie or any other 8 cyl. magnetos suitable for Hispano engine. Must be in good condition if not new. Address Aero Distributing Co., 17 East 42nd St., New York City.

NEARLY NEW CANUCK, 25 hours, motor top overhauled. Fuselage red. Ship in perfect condition, good stock of spares including one rudder, aileron, axle, casing, wires, fittings and others. Price $2200. F. Gerald, Newark Hotel, Asbury Park, N. J.

FOR SALE OR TRADE—Detroit 2 cyl. opposed 30 H.P. aviation motor $100.00. Also small sport plane with rebuilt Ford motor $150.00. Address P. C. Houston, 87 14th Ave., Columbus, Ohio.

WANTED IMMEDIATELY—Pilot with own ship, opportunity to connect with motion picture attraction about to tour the east. Pacific Coast in fall. Excellent proposition if you qualify. Address Chas. H. Barolet, Special Representative, 145 Harrison St., Providence, R. I.

LINCOLN STANDARD 3 SEATER, Wright Hispano motored plane for sale. Highest cash offer takes it. Plane and motor excellent condition. Spares, tools, etc., included. Never crashed. Address Box No. 587, c/o Aerial Age Weekly, 280 Madison Ave., New York City.

GNOME 50 slightly used, just overhauled, complete and in A1 condition. Crated ready to ship for $250.00. Address Cassell Ferris, 6840 Alpine, Silverton, Ohio.

FOR SALE—Standard J1 with OX5 motor; been in air eight hours. Price very reasonable. Address Venard Film Corp., Peoria, Ill.

PATENT FOR SALE—New and useful improvement in telescopic airship (Aerial & Marine craft, of dirigible Balloon class.) I. Pantelic, 183 West Street, New York City.

FOR SALE—Curtiss "F" boat. Good condition. Will demonstrate. Very reasonable price. Address Box 43, Havre de Grace, Md.

FOR SALE—Curtiss JN4D. Excellent condition. Aluminum paint, new motor, spare motor, extra propeller, rudder, etc. Ready to fly away. Exceptional bargain. Phone Vanderbilt 322.

(*Concluded from page* 253)

of the battleship, light cruiser, destroyer and submarine types.

That these experiments carried out at sea in deep water will demonstrate the effect of an aeroplane bombardment of naval craft more effectively than experiments conducted with the vessels at anchor in shallow water.

That the experiments outlined by the Navy Department do not contemplate experiments in the use of machine guns against personnel in exposed positions nor the effect of gas, incendiary, and smoke bombs.

That the tactics to be used in attacking naval vessels by aircraft are not well developed.

(*Concluded from page* 249)

Nevada, last month while flying over the western end of the transcontinental air route encountered a violent blizzard. The snow was so dense that visibility at 50 yards was the maximum. He cleared one range of mountains when another mountain came suddenly into view 50 yards ahead. He promptly pulled his guiding levers to the limit, hoping against hope to clear the mountain, but the crash was inevitable.

Another pilot flying between Chicago and St. Louis recently through a sleet and snow storm was so cold, sore and stiff when he reached Chicago, that he had to be assisted out of his ship.

Fortunately no fatalities occurred in these accidents.

Chemical Reaction Affects Casein Glue

Although casein glues are highly water-resistant, they ultimately decompose when exposed to a damp atmosphere for a long time. For many months studies have been under way at the Forest Products Laboratory to discover the cause of this decomposition.

The decomposition study is still far from complete, but the conclusion has been reached that the decomposition of ordinary alkaline casein glues is not due to the action of bacteria or molds. It appears to be due entirely to chemical action of the alkali in the glue. This conclusion is based upon the following observations:

Increasing the amount of alkali in the glue increases the rate of decomposition when the glue is kept wet.

Glues containing no sodium hydroxide, although deficient in some important respects, do not decompose as rapidly as similar glues containing sodium hydroxide.

Cultures of molds and bacteria could not be obtained from decomposed alkaline glues.

Some chemicals which have antiseptic properties are found to improve casein glue, but this improvement is due to their chemical action rather than to their toxic properties.

Glues can be completely decomposed in a short time at temperatures above that at which bacteria can grow.

Further work is being directed toward the production of glues which will resist chemical decomposition and at the same time be impervious to the action of fungi and bacteria as well as moisture.

When to Machine Casein Glue Joints

Casein glue sets very quickly and produces a joint strong enough to machine in a few hours. In tests at the Forest Products Laboratory casein glue joints in spruce proved as strong as the wood after 4 hours and in hard maple after 6 hours. When maximum speed of production is essential, such woods may be machined at the end of the periods stated, without sacrificing the strength of the joint. In some kinds of work, however, machining so soon after gluing is not advisable, because of the danger of warping or the production of sunken joints as the moisture content of the glued wood equalizes.

Another important factor brought out by the tests on joint strength is that joints released from pressure at the end of 2 hours and then allowed to season for 22 hours proved as strong as those that had been pressed for 24 hours. Joints pressed for only ½ hour and seasoned, although of good strength, on the average, were somewhat erratic in this respect and probably would not be dependable where maximum strength is important.

Abilene Aviation Company Formed

The Abilene Aviation Company was recently formed at Abilene, Texas, for the purpose of passenger carrying, exhibition flying, aerial advertising and a general sales agency. J. W. Locking is President of the company and Lieut. Eric A. Locking, Chief Pilot and Instructor.

AERIAL AGE WEEKLY

OL. 13, No. 12 MAY 30, 1921 10 CENTS A COPY

© Fairchild Aerial Camera Corp

Airscape of the Cathedral of St. John the Divine

The Deutsch De La Meurthe Trophy

BLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
bscriptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

G. DOUGLAS WARDROP
Editor
B. C. BOULTON
Contributing Technical Editor
G. F. McLAUGHLIN
Contributing Technical Editor
NORMAN E. JENNETT
Art Editor
H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce In London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIII NEW YORK, MAY 30, 1921 NO. 12

THE DEUTSCH DE LA MEURTHE TROPHY

WHEN the Gordon Bennett Trophy was won outright last year by the French entrant it was feared that the curtain had been run down on one of the most interesting international flying events. It is therefore gratifying to know that another contest will take the place of that for the Gordon Bennett Cup.

The *Coupé Deutsch de la Meurthe* is to be a speed race pure and simple. There are no restrictions of any kind, no minimum landing speed nor any useful load over and above the weight of the pilot and fuel. It has often been argued that some restriction should be imposed in races of this description so as to avoid freak machines. While on the face of it this contention appears to be justified, on further thought we are inclined to think that restrictions of this sort, for a race which is intended to be a contest between the fastest machines in the world, are superfluous, or even harmful. After all, the designers of an aeroplane, and the pilots, are probably the best judges of what is or is not a safe machine. If the personal element did not enter into the question to such a great extent it would be different, but what is safe for one particular combination of pilot and machine may be distinctly unsafe for another combination. And to have one great international speed race every year, although it may superficially appear to be of little practical use, is in reality of the greatest importance. Nothing finds the weak spots in a design as quickly and as surely as a speed contest. When speeds of round about 200 m.p.h. are attained, it is the machine in which the greatest care has been paid to minute details which will prove just that mile an hour faster which is or may be enough to make the difference between winning and losing the race. Thus the racing machine must of necessity be the ultra refined design, with resistance reduced to an absolute minimum.

As regards the Coupé Deutsch itself, the race will be flown over the old Gordon Bennett course, from the Villesauvage aerodrome south of Etampes to La Marmogne near Gidy and back, a distance of 300 kilometers (186 miles). The prizes are an *objet d'art*, valued 20,000 francs, and a money prize for the winner each year for three years of 60,000 francs. Apart from the commercial value to any firm of having won the Coupé Deutsch, and the considerable prizes offered, the prestige of a country is greatly enhanced by making a good showing in such a race. It is therefore to be hoped that this year will see several American machines at Villesauvage. There are close on five months left in which to produce a machine for the race, and as several firms are contemplating entering machines for the Pulitzer Trophy, we hope that they will, at the same time, keep in mind the Coupé Deutsch. Last year three American machines were actually at Villesauvage during the Gordon Bennett, two of them taking part in the race. If we are to have any hopes of winning the Coupé Deutsch we will have to make a better effort than we made last year for the Gordon Bennett. Concerted action and thorough organization is required. We are equal to producing machines worthy of the great race. Let us show that we are also capable of using them to the best advantage. We would call the attention of manufacturers to the dates: The race itself on October 1. Entries close August 27. Machines must be on the aerodrome at Villesauvage by September 30, but to make sure, and to allow pilots to make themselves familiar with the course, it will be better to have them in readiness a couple of days before that date.

Efficiency and Economy of Aerial Survey

IN recent issues we have called the attention of our readers to aerial surveying as a modern and efficient method of speeding up this character of work.

A report recently prepared for the Chief of the Air Service by Capt. Lowell H. Smith, commanding the detachment from the 91st Aero Squadron which was detailed to co-operate with the U. S. Forestry service in making a survey from the air of the cyclone-swept district of the Olympic Peninsula in the State of Washington, shows that by this one performance the U. S. Army Air Service has saved the public from $125,000 which, it is estimated would have been the cost of a ground survey, to possibly millions of dollars by reason of information obtained which will be invaluable for use in fire prevention in this wind-blown region.

The total time required for making this aerial survey was 68 hours, 20 minutes: the total cost was $2,524. It is estimated that a ground survey would have required from two to three years, at an expense of $125,000. Meanwhile the menace of fire would have been an ever-increasing one, likely at any moment to become a reality, and so to add millions more to the work of destruction.

Demonstrations such as this should go far to persuade Congress that aeronautic appropriations are the best possible insurance for our forest reserves. They should check off in their mind the national saving of our lumber against the amount of money appropriated for aeroplane construction and at the end of any one fiscal year they will be surprised.

THE NEWS OF THE WEEK

Nine Balloons in Elimination Race

Birmingham.—The 1921 national elimination balloon race got under way shortly after 7 o'clock May 21 with the departure from the starting field of the balloon Atascadera, Calif., piloted by Captain John Berry, of St. Louis. The big bag sailed westward at about twenty miles an hour, and the eight other contestants followed at five-minute intervals in the following order:

Birmingham Semi-Centennial, Ralph Upson, New York, pilot; C. J. Andrus, aid.

St. Louis No. 5, J. S. McKibben, St. Louis, pilot; C. W. Merrell, aid.

City of Akron, Wade T. Vanorman, Akron, pilot; Willard P. Seiberling, aid.

City of Birmingham, Roy Donaldson, pilot; W. E. Robinson, of the University of Illinois, aid.

Army, Lieutenant Colonel Frank P. Lahm, pilot; Major Oscar Westover, aid.

Review Club of St. Louis, Bernard Von Hoffman, University of Missouri, pilot; Hugo Mueller, aid.

The Chamber of Commerce of St. Louis, H. E. Honeywell, St. Louis, pilot; J. M. O'Reilley, aid.

Navy, Lieutenant Commander L. J. Roth, pilot; Lieutenant H. E. Hallard, aid.

Weather observations taken just before the start were said by Weather Bureau officials to indicate that the balloons would continue westward until the Mississippi River was crossed and then they would change to a northwest course and finally the air currents would turn the course to the north and northeast, bringing the balloons to the Great Lakes region.

Captain Berry, who recently celebrated his seventy-fifth birthday, is the oldest pilot, while Von Hoffman is the youngest, being a few months short of his majority.

Colonel Lahm won the first Gordon Bennett race and Ralph Upson carried off the honors in 1913.

Postmaster Hays Flies to New York

Mineola.—Postmaster General Will Hays made his first aeroplane trip May 21 when he was a passenger in a De Haviland plane piloted from Washington to Mitchel Field by Brigadier General William Mitchell, assistant chief of the United States Air Service. They left Bolling Field, Washington, at 2:45 o'clock in the afternoon and arrived here at 4:45.

Mr. Hays, when he reached the ground, said that he enjoyed every mile of the trip.

"It was the most instructive and interesting experience I ever had," he said. "I wanted to get some first-hand knowledge of the route used by flyers in the aerial mail service. We flew over Wilmington, Philadelphia, Trenton, Newark and the East Side of Manhattan.

Aces to Make Up Crack New York Flying Corps

Lieutenant Colonel Edward Olmstead, acting chief of staff of headquarters, New York Division, National Guard, announced the organization of a flying corps for home defense, to be made up of famous aviators, who won distinction in the war. Lieutenant Colonel Olmstead declared New York City would have the crack flying corps of the country. Its headquarters will be at Mitchel Field.

Among the famous aces who have applied for commissions in the corps are Captain George A. Vaughn, jr., of Princeton University, who had thirteen German planes to his credit while serving in the 81st Squadron of the British Air Force; Captain Elliott Springs, also a Princeton man, with fourteen victories to his credit while with the 148th Squadron; Major Landis, Amherst, ten victories, 40th Squadron, R. A. F.; Lieutenant Chester F. Wright, Harvard, nine official victories with the 93d Squadron; Lieutenant Howard Burdick, Wesleyan, seven victories, 17th Squadron; Lieutenant Lansing C. Holden, jr., Princeton, seven victories; 95th Squadron; Lieutenant Sumner Sewell, Yale, and Lieutenant Ted Curtiss, Yale, both of the same 95th Squadron and each credited with seven victories.

Ten American Voyagers Want Air Buses to Paris

Paris.—The largest Paris aerial transportation company received a telegram from ten Americans on May 22, who have booked passage on the Aquitania from New York, to have air buses ready at Cherbourg on May 30, upon the arrival of the Cunarder, to transport passengers to Paris immediately. It is explained that the Americans wish to attend the Memorial Day ceremonies at Paris.

Plan Week-End Flights to Thousand Islands

An air service making possible week-end trips to the Thousand Islands has been announced by the United States Airways, Inc.

The airways company plans to start the service before the middle of June. A big HS-2 flying boat, with 400 horse-power Liberty motor, will fly three times a week from New York and three times from Alexandria Bay. This air cruiser, which has a wing spread of 74 feet, will accommodate five passengers. The week-end service will permit New York business men to leave this city early Friday afternoon, reach the islands in the St. Lawrence in time for dinner, embark once more early Monday morning and reach here in time for business Monday afternoon.

The new company, incorporated last week at Albany, is headed by William H. Warburton, proprietor of the Thousand Island House and the Crossmon House, Alexandria Bay. The offices of the company are in the Times Building. James Taylor Lewis is counsel and chairman of the board of directors. Other aircraft will go into service on routes around the Great Lakes and St. Lawrence.

Detroit University to Have Aeronautic Course

Detroit.—The University of Detroit on May 19 announced plans for a five-year course in aeronautical engineering. Lieutenant Thomas F. Dunn has been appointed dean of the new department, which will be opened at the beginning of the next school year.

Special laboratories, a flying field and a machine shop are to be provided. The course will include, besides designing, construction and flying of aircraft, instruction in higher mathematics, mapping, astronomy, physics, meteorology, weather calculations, chemistry, wireless telephony and telegraphy, commercial law and aerial photography.

Scene at the opening of the Field Club of the Aero Club of America, Curtiss Field, Garden City, on May 15

Municipal Field at Staunton, Va.

Staunton, Virginia has put itself on the aerial map by establishing a municipal landing field in accordance with U. S. Army Air Service specifications. Mr. E. W. Opie of the aviation landing field committee of the Chamber of Commerce has sent in the Questionnaire which gives the following statistics:

Name of field, Lyle; shape and dimensions in feet, 650 x 400; direction of long axis, North-South; Markers, according to A. S. specifications; Contour of field, hilly on west side, slight rise to north, with level runway in center; landing possible in wet weather; slight rise and rocks at north end, low fence around entire field, telephone wires at south end, ditch on east side, but all at such distance from runway as to be negligible, according to pilots who have used field. Small airdrome would be possible; high grade of supplies available at Beverly Garage, ¾ mile from field in business section; field located on northern outskirts of town, about one mile northwest of intersection of Chesapeake and Ohio, and Valley Branch of Baltimore and Ohio Railroads; altitude above sea-level, 1,600 feet; Staunton and Augusta Chamber of Commerce operating field; Charles B. Ralston, Secretary, official interested; field open to all pilots; Lynchburg, Air Service Corporation, Lynchburg, Va., now using this field.

The Aeroplane and Sanitation

Major M. F. Harmon, Jr., recently stationed at France Field, calls attention to the fact that the aeroplane has added to its record of adaptability by being utilized in Panama for getting rid of breeding places of the anopheles mosquito.

In a recent news item it was announced that a British colony had developed a new use for aviation, i.e., "The aeroplane as an aid in the sanitation of mosquito breeding areas."

Attention is invited to the fact that for over a year the 7th Aero Squadron at France Field, Panama Canal Zone, has been doing work of this nature. At the specific request of Colonel Henry Greenlief, Department Surgeon, visual and photographic reconnaissance were made of the swamp areas contiguous to the Atlantic entrance to the Canal. Photographs of areas showing main and lateral drainage ditches and points where new laterals were required proved of assistance in the sanitation of anopheles ridden districts.

Holdredge Aerial Tournament

An aerial tournament was staged at Holdredge, Nebraska, on May 5, 6 and 7. There were 22 planes on the field and the events drew a crowd of 25,000 spectators. The tournament was a decided success from every angle in spite of the fact that the high winds prevented many of the stunts during the time the greater number of people were present.

Following is a list of the prize winners:

50 mile cross country race: First—Curtiss Oriole, K-6, Smith, Grand Island, pilot, time 30.3; second—Laird Swallow, Blevins, Wichita, Kansas, pilot, 32.0; third—Curtiss JN 4D: Kite, Grand Island, pilot, time 33.8.

Contour chase, 8 miles: First—Curtiss Oriole K-6, Smith, Grand Island, pilot, time 5.40; second—Lark Monoplane, Bahl, Lincoln, pilot, time 6.15; third—Laird Swallow, Blevins, Wichita, pilot, time 6.55.

Hurdling: First—Curtiss JN 4D, Smith, Grand Island, pilot, distance 200 feet; second—Curtiss JN 4D, Kite, Grand Island, pilot, distance 233 feet; third—Curtiss JN 4D, Wagner, Red Oak, Iowa, pilot, distance 250 feet.

Spot landings: First—Lark Monoplane, Bahl, pilot, 57 feet; second—Curtiss JN 4D, Kite, pilot, 96 feet; third—Curtiss JN 4D, Wagner, pilot, 110 feet.

Acrobatics: First—Curtiss JN 4D, Smith, pilot; second—Curtiss JN 4D, Wagner, pilot.

Wesley May cranking propeller from nose of machine while in the air over Daugherty Flying Field. Earl Daugherty pilot

House Committee Approves Carrier

Washington,—The House Naval Committee on May 17 approved a bill authorizing construction of a high speed aeroplane carrier to cost approximately $25,000,000 and carry about eighty planes.

Secretary Denby recommended immediate construction of such a ship.

Chicago Post Office Roof Landing

According to newspaper dispatches from Chicago aeroplanes carrying mail will land on the roof of the new government postoffices to be erected here, officials have announced. The cargoes will be conveyed to trains or motor trucks via belts or tunnel cars.

Additional World Commissioners

The World's Board of Aeronautical Commissioners, Inc., has been increased to ninety-four members in seventy-seven countries and colonies by the addition of the following:

Czecho-Slovakia, Prague, Geberal Stanislaw Cecek; Denmark, Copenhagen, Captain H. C. Ullidtz; Malta, Valetta, Captain A. Zammit Cutajar; New Brunswick, Rothesay, W. R. Turnbull, Esq., M.E.F., R. AeS.; Portugal, Lisbon, Commandant Alberto Lelo Portella, Civil Governor of Lisbon; Prince Edward Island, Charlottetown, H. R. Stewart; Samoa, Apia, O. F. Nelson; Tahiti, Papeete, James Norman Hall; Transvaal, Johannesburg, Lt. Col. Vicomte de Sarigny, O.B.E.

Varney Transcontinental Circus

Walter T. Varney is organizing an aerial circus that will shortly leave San Francisco on an itinerary that will take it clear across the continent to New York. Cloyd P. Clevenger will be manager of the outfit.

Aeroplanes Bring Late Passengers to Ships

Americans homeward bound, but desiring to stay until the very last minute in France, are finding aeroplanes useful in catching transatlantic steamships. So constant are last hour arrivals at the principal French ports that French aeroplane companies outside of Paris are now holding three aeroplanes in reserve daily for delayed American voyagers from Cherbourg and Havre, and are doing a "rushing" business. Just before the Aquitania steamed from Cherbourg, the American Express Company's representative in Paris, accompanied by an American, flew to that port and signalled for a small boat to carry them to the Aquitania. They not only took baggage in the aeroplane, but also several bags of mail for the United States. The cost of hiring an aeroplane for a journey of three hours is approximately $300.

Aviation in Peru

The National Company of Aeronautics, Lima, Peru, a company doing commercial work, began in July, 1920. Up until this company came to Peru, there had been no civil aviation, with the exception of some missionary work started by Mr. C. W. Webster of the Curtiss company. The above company is owned and operated by a former army officer, Maurice A. Mott, and a former navy officer, Lloyd Moore.

For the past two years, the Peruvian government had tried to start a department of aviation, having French officers to direct it, after two different French missions had tried and the government had spent about 30,000 Lps, and still they had failed to turn out any pilots. The government decided to run it, under the direction of Juan Liguia, son of the President, and at the present time they have a very nice field, a number of good ships and are doing a great deal of flying; and it is hoped that in the near future they will have some good military pilots.

Commercial aviation has been a success from the start, owing to the bad roads, bad coast steamship service, etc., and the National Company, up to the present time, has flown 1,157 hours, carried over 1,200 passengers, carried over half a million dollars in trips to different places, besides many exhibition flights, and has also turned out 11 pilots. The Peruvian is a person who takes to flying, loves it, it has just the right thrill to it to appeal to him, the young men learn to fly readily, and a good many of them have their own ships for pleasure.

The air conditions are wonderful, and one can fly 365 days in the year, as they have no rain, and the clouds are, as a rule, over 1,500 feet. There are natural landing fields in every town on the coast, and in the mountains, they must have seen aviation coming, for each town has a large pampa near by. In going to some towns it is necessary to cross the mountains at an altitude of 15,000 feet, and over.

The Government has established a school for marine aviation at Ancon, and are using the Curtiss Sea Gull as training ships, with great success. This school has been running for some time, the instructors are Americans, and they have turned out a number of fine pilots.

It may be luck, if so it is certainly awfully good luck for Americans, but the only ship that has made trips from Lima to other towns and returned, without having to have parts, and mechanics sent to repair it for its return, has been American, Curtiss; the National Company has made over forty trips of over 50 miles, and up to the present time, always returned without any delay whatsoever. May the luck continue.

Skylark Flies From Bethlehem to Garden City

The Baco "Skylark" made its debut at the Curtiss-Hazelhurst Field to the surprise and admiration of several thousand spectators Sunday, May 15th, while the Aviation Meet was in full flight.

Following is Pilot Erzting's story of the trip:

"Saturday, May 14th, at 4:30 p. m. we took off from Bethlehem, Pa., making a half circle of the field and heading for New York, practically due east. We passed over Easton at 2,000 feet altitude and from there on throttled down to a cruising speed of 78 miles per hour.

"On reaching New York City above the Statue of Liberty an altitude of 6,500 feet was attained.

"Above Jamacia, L. I., we throttled down gliding all the way into Mitchell Field. During the glide both feet were removed from the rudder bar and hands off the control stick and the machine kept on its course in a perfect glide in this 'hands off' condition, proving that it has as remarkable stability in a glide and turn as it has in straight flying under full power.

"We landed at Mitchell Field at 5:30. One hour from Bethlehem, Pa., to Garden City, L. I. By rail this trip would take at least 3½ hours with prompt connections at the Pennsylvania Station in New York City."

Sunday, May 15th, Mr. E. M. Robinson of Bethlehem, Pa., Mr. Bucher, New York *Times* representative, were taken up for an airing and Mr. Farmer of the National Air Service photographed the Meet, and machines in the air, from the "Skylark."

Aerial Mail Service Openings.

The Civil Service Commission announces open competitive examinations for aeroplane mechanics' helpers, motor and fuselage, applications for which will close June 28. The salaries range from $1,000 to $1,800 a year. Applicants should apply for Form 1800 to the Civil Service Commissioner, Washington, D. C.

Comparative Value of Filtering Mediums for Gasoline

The relative amount of static electricity generated by friction between gasoline and filter in the case of various materials was measured by the Engineering Department of the Air Service, by taking a charge generated in the same way from each of the materials. The relative strength of each charge was measured and tabulated. Chamois skin generated a very large charge, while cotton goods generated a very small charge. Woolen felt did not generate a very large charge in comparison to chamois skin.

Any small capillary filtering medium is impervious to water when wet with gasoline. The two liquids are practically insoluble to each other, and the coefficient adhesion between their surfaces is very small. However, the liquids are very adhesive to leather, wool, or cotton. Consequently, the capillaries of the filter must be small enough so that the weight of small amounts of water will not overcome the resistance offered by adhesion of the gasoline to filter plus the sum of the resistance offered by surface tension of both liquids.

It is directed that cotton moleskin be used for filtering gasoline instead of chamois. In case moleskin is not available, cotton twill will be substituted.

Examination for Aeronautic Engineer

The United States Civil Service Commission announces an open competitive examination for aeronautic engineer. Vacancies in the Naval Aircraft Factory, Navy Yard, Philadelphia, Pa., at $5.44 to $11.68 per diem, and in positions requiring similar qualifications, at these or higher or lower salaries, will be filled from this examination, unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer, or promotion.

Applications should be on Form 1312, which can be secured from the Civil Service Commission, Washington, D. C.

Air Service Bids

AEROPLANES—Engineering Division, Air Service, McCook Field, Dayton, Ohio. —Bids are wanted until 2 p. m., July 18, for furnishing the following types of experimental aeroplanes in quantities indicated, to be designed and constructed by the successful bidders: Type 12, in quantities of 2 and 3 aeroplanes, 2 or multi-seater, night bombardment, short distance, water-cooled engine; type 13, in quantities of 2 or 3, multi-seater, night bombardment, long distance. For information address, Capt. R. H. Fleet, Air Service, contracting officer.

AEROPLANES—Engineering Division, Air Service, McCook Field, Dayton, Ohio. —Bids are wanted until June 15 for furnishing the following types of experimental aeroplanes in quantities indicated: Type 1, 3 aeroplanes, single-seater pursuit, water-cooled engine; type 3, 3 aeroplanes, single-seater pursuit, air-cooled engine; type 5, 3 aeroplanes, 2-seater pursuit, water-cooled engine; type 14, 3 aeroplanes, 2-seater training, air-cooled engines; special type, 3 aeroplanes, no special specifications applicable, general requirements governing the construction of aeroplane in handbook of instructions to be followed, and engine, armament and equipment will be furnished by the government; this aeroplane to be a single seater pursuit, with air-cooled engine, intended for defense of airdromes or home stations. For further information address above.

AEROPLANES—Engineering Division, Air Service, McCook Field, Dayton, Ohio. —Bids are wanted until 2 p. m., July 11, for the following types of experimental areoplanes, in quantities indicated, to be designed and constructed by the successful bidders. Type 8, 3 aeroplanes, 2-seater night observation, water-cooled engine; type 9, 3 aeroplanes, 3-seater Army and coast artillery observation and surveillance, water cooled engine; type 10, 3 aeroplanes, 2-seater corps observation, water-cooled engine; type 5, 3 aeroplanes, 2-seater training, water-cooled engine, two separate proposals are required under this item, as follows: With types A, I or E, Wright engine or 160-h. p. Packard engine and with Curtiss OX-5 engine. Address above.

The Sperry Monoplane Wing

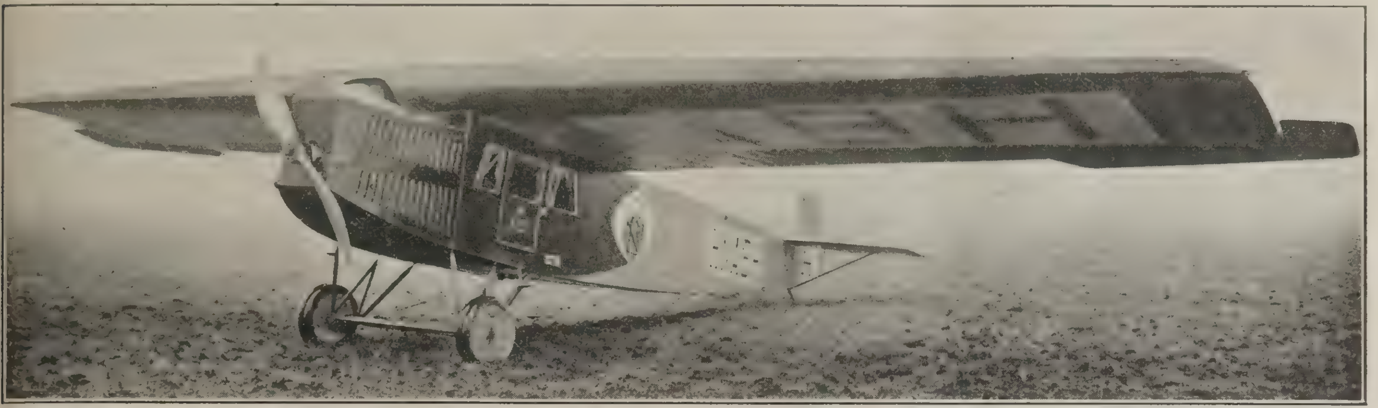
The monoplane wing which the Lawrence B. Sperry Co. have developed for Canuck, Curtiss and Standard planes, has aroused considerable interest throughout the country amongst users of these planes.

The following performance table of what the various types of planes will do with the Sperry wing, is interesting:

Plane	Motor H.P.	High Speed M.P.H.	Landing Speed M.P.H.	Useful Load lbs.
J-N—or Canuck	0x	75	35	800
J-N—or Canuck	0xx	80	35	800
Standard J-1	0x	75	35	800
Standard Curtiss K-6	150	90	38	900
Standard Hispano ..	150	90	38	900

As will be noted from the illustration the wing is mounted well overhead the passengers and does not interfere with their vision. The machine has been stunted by one of the best pilots in the country, who immediately arranged to secure a wing for his stunt machine for work this summer.

The Sperry Monoplane Wing, the performance of which is described on this page



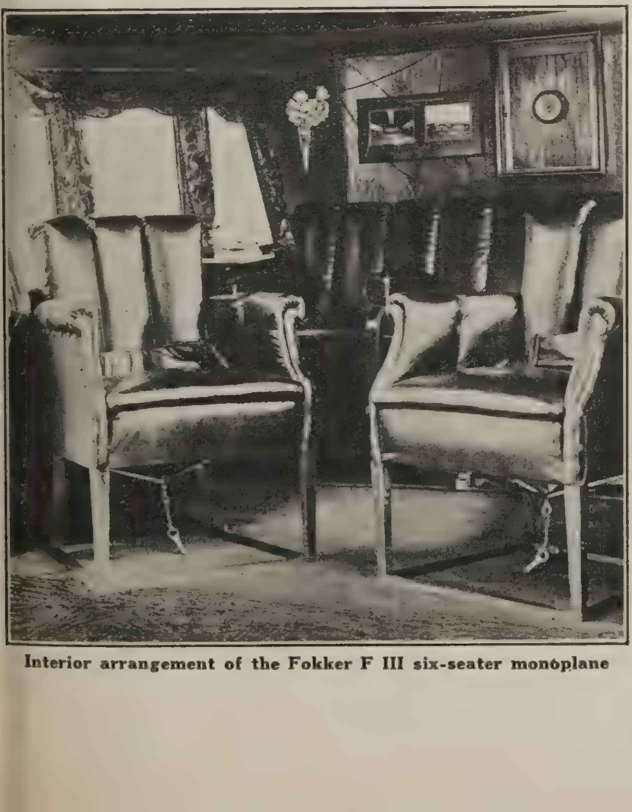
THE FOKKER F III SIX-SEATER MONOPLANE

THE Fokker F III carries, besides the pilot and 5 hours' fuel, 5 passengers and their baggage, or 1,000 lbs. of freight, with a motor of only 220 H.P. using about 12 gallons of gasoline per hour. With this load the machine has a speed of 105 miles per hour and radius of action of over 500 miles. Long distance services are usually split up into stages falling within this radius, but arrangements can easily be made for a greater fuel capacity if required.

The Engine fitted as standard is the 220 H.P. B.M.W., an excellently made and very reliable motor, but practically any other vertical six cylinder from 185 - 260 H.P. can be fitted with very little alteration.

The Radiator is installed in the nose and is of ample surface, while the temperature can be regulated by the pilot to suit weather conditions or altitude, by means of shutters. The greatest possible safety against fire is provided by enclosing the engine compartment completely with aluminum sheet and by the steel tube construction of the engine mounting and housing. The latter are so designed that the engine is easily accessible on all sides on removing as much of the detachable cowling as is necessary. By this means the labor cost and loss of time in making mall adjustments or removing and regulating the whole engine are reduced to a minimum in this machine.

The Engine Installation and the Gasoline System are arranged in the simplest way possible and show the benefit of the designer's many years of experience as a pilot; all chances of fire have been studied and eliminated. The Gasoline Tank, which feeds the carbureters by gravity only, through one pipe, is placed high up, between the big spars in the wing, where it cannot be damaged in a bad landing; it is well protected from fire and so well separated from the cabin that passengers may be allowed to smoke, a comfort which has so far been denied them in other passenger machines.



Interior arrangement of the Fokker F III six-seater monoplane

To avoid the usual spilling about of gasoline while filling up the tanks, this operation is done in the Fokker machine direct from the ground supply by means of a pump which is a fixture in the machine. Gasoline level in the tank is shown by a special type of gauge in the pilot's cockpit.

The Pilot's Cockpit is directly next to and slightly further back than the engine; being placed high up and on one side, the pilot has a clear view forwards, directly downwards on one side and diagonally downwards on the other, a position which is very good all around, both for orientation and landing. He is well protected against bad weather and can get into his seat very easily through a door in the side. Fittings and instruments are reduced to the minimum desirable and are accessibly arranged.

The Controls are of the usual type, with a wheel for the ailerons.

The Fuselage is constructed on the usual Fokker system of steel tube, which proved so successful in the thousands of machines used in the war. It is remarkably strong, very durable and easily repaired in case of damage by methods obvious to any mechanic.

The Passenger Cabin is a very roomy comaprtment and most comfortably fitted up. Normally club easy chairs for 5 passengers are provided, of which 3 are fixed and 2 movable, all facing forwards. There are 3 big windows in each side, 2 of which can be let down for ventilation; they are fitted with curtains and the floor is carpeted. Besides a clock and an altimeter, the usual fittings and ornaments of a high-class limousine are provided, while on regular air lines a map of the route and a series of air photographs of towns and points of interest which are passed can be fixed on the front wall of the cabin. For the winter, heating apparatus is provided so that it is totally unnecessary to wear special clothing even in the coldest weather and at the greatest heights. The cabin is entered by a full-sized door, which is only 2 steps up from the ground.

There is a space for baggage between the back of the fixed seats and the wall of the cabin.

In cases where the machine is used for carrying mail or freight only the seats can be removed, leaving a clear capacity of 170 cubic feet.

The absence of a lower wing and bracing structure of any kind provides an entirely unobstructed field of view sideways and downward, a feature which, coupled with its marvelous slow glide, makes this machine of extraordinary value for purposes where accurate observation is required, such as photography, surveying, forest patrol, bombing, parachute dropping, etc. It is interesting to note in this connection that the Dutch Government Research Department uses a Fokker F-11 machine as a flying laboratory, instruments, models, etc., being mounted some distance under the wings and readings taken in comfort inside the cabin.

Behind the cabin the body starts to taper, ending in a vertical knife edge, to which the balanced rudder is hinged. The Tail Plane is fixed to the top of the fuselage and obtains its strength from a transverse cantilever beam in front and a diagonal steel strut at the rear, which connects with the bottom of the fuselage. The Elevators, divided and balanced, are hinged to the tail plane. The control surfaces are all made of steel tube and can be changed in a few minutes. The tail skid is very strongly made, of ash, and sprung by steel spiral springs inside the body.

The Chassis is also all steel and exceptionally strong; the struts form a W on either side, instead of the usual V, so that the fuselage is supported at 6 points; sideways, the chassis is

braced by double cross struts and a double set of cables. The axle is of large dimensions and rubber sprung. To prevent sinking in soft ground, or a bad landing through a burst tire, the wheels are double and consist of two normal rims spoked to one hub.

The Wing is of the thick, internally braced type, has a span of 52 ft. 9 inches at the tips, and is 25 inches thick at the center. It is built with two immensely strong box spars, on which solid three-ply ribs are fixed with corner pieces. The covering of the whole wing is also of three-ply wood, which stiffens the wing completely and dispenses with the usual fabric covering which is so easily damaged and deteriorates so quickly. The calculated factor of safety on the spars is 7, but load tests have proved that, with the covering, ribs, etc., this factor is raised considerably, as there is actually a breaking load factor of between 9 and 10.

The great thickness of the wing, its cubic capacity and the fact that the ribs divide it up into a great number of absolutely watertight compartments, enable the whole machine to float practically indefinitely in the event of a forced landing in the water; in this case the passengers get on top of the machine through the emergency exit which is provided in the roof.

The ailerons are balanced like the rudder and elevators. The control cables are carried through the wings and the pulleys are accessible through inspection doors.

The fixing of the whole plane, directly on the top of the body, is carried out by four bolts of which the dimensions give a safety factor of 14. This simple attachment gives the greatest certainty that the connection of wings and body is always in order and of course permits the quickest erection imaginable.

Specifications

Span over all.....56 ft. 3 in.
Length over all.....36 ft.
Height over all.....11 ft.
Wing area.....452 sq. ft.
Weight, fully loaded.....4,400 lbs.
Weight, empty.....2,640 lbs.
Useful load.....1,760 lbs.
Paying load with 5 hours' fuel.....1,050 lbs.
Engine.....220 h.p. B.M.W.
Fuel consumption per hour:
Gasoline.....12-14 gallons
Oil.....1 gallon
Performance:
Maximum speed.....105 m.p.h.
Climb.....10,000 ft. in 30 min.

Side view of the Fokker F III six-seater monoplane

AEROPLANE SUPERCHARGERS*

By W. G. NOACK

Former Engineer, Board of Aeroplane Experts, Charlottenburg

THE ever-increasing demands on the aeroplane during the war, with regard to climbing speed and ceiling, necessitated the installation of engines of constantly increased power, while the carrying capacity and speed at a serviceable altitude did not proportionately increase. The reason for this is to be found in the fact that the engine power output decreases with the increase of flying altitude. If, for instance, an aeroplane is still to be able to fly at an altitude of 5 or 6 km., then the engine must be of about twice the power at sea level that would have been sufficient to keep the aeroplane in flight in the vicinity of the ground.

The principal reason for the falling off of the engine power is the decrease in the density of the air as the aeroplane rises. The manner in which this occurs may be seen in Table I,** which gives the average barometer pressures and temperatures during the year, and also the relative pressures. Generally speaking, if y stands for the density of the air (when leaving out moisture as for every gas), and b signifies the pressure and t the temperature:

$$y = y_o \frac{b}{760} \frac{273}{273 + t};$$

in which $y_o = 1.293$ kg/cu.m., the density of the air at $b = 760$ mm. mercury column and $t = 0^oC$.

TABLE I

Decrease of the Air Pressure With the Increase in Altitude

Altitude above sea level m.	Average air pressure b mm. mercury	Average yearly temperature tm ^0C	Relative air pressure $\frac{b}{b_o}$	Average density of the air y kg/cu. m.	Relative density of the air $\frac{y}{y_o}$
0	762	+ 8.7	1	1.258	1
1000	674.5	+ 3.9	0.885	1.130	0.900
2000	596	— 1	0.782	1.020	0.810
3000	525.5	— 5.9	0.689	0.914	0.727
4000	461.5	—11.6	0.605	0.820	0.653
5000	405	—16.9	0.531	0.735	0.584
6000	354.5	—23.7	0.465	0.660	0.524
7000	309.5	—31	0.400	0.595	0.473
8000	269.5	—37	0.357	0.532	0.423
9000	240	—45	0.315	0.489	0.388

If the falling off of the engine power were dependent upon the density of the air alone, then the same relation would hold good for both. This is, however, not generally the case. As has been shown at the altitude experimental stations, the efficiency of the usual aeroplane engines falls off considerably faster. The reason for this is to be found, first of all, in the action of the carburetor. The fuel supply in the carburetor does not decrease in the same degree as the weight of the air inducted at each piston stroke, the fuel mixture becomes too

* Sonderabdruck aus der Zeitschrift des Vereines deutscher Ingenieure, Jahrgang 1919, Seite 995.

** Also see A. Wagner, "Contributions Relating to the Composition of the Atmosphere," III, 1919.

rich and the thermal efficiency is also decreased, because, with the number of revolutions remaining the same, the no-load work of the engine, which is affected by the diminished working pressure but little, remains almost the same; its ratio to the power output, however, increases with increased altitude. With the very low temperature prevailing at high altitudes, the inducted air may affect the formation of the mixture unfavorably when not sufficiently heated. For a confirmation of the above we refer to the performance of one of the best of the older German aeroplane motors * as shown in the curves given in Figs. 1 and 2, in which the power for various inductional temperatures is plotted in relation to the density of the

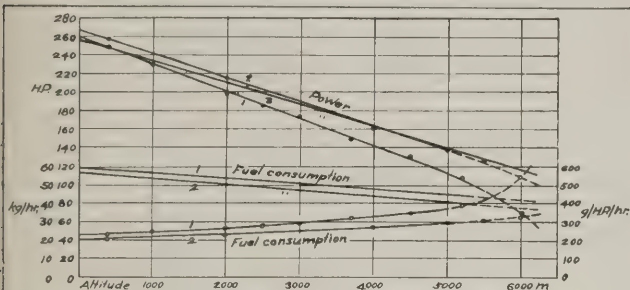


Fig. 1 Power and consumption of a 260 H.P. airplane engine at 1450 R.P.M. with increasing altitude. The upper consumption curves represent kg/hr; the lower curves the rate per HP/hr in grams

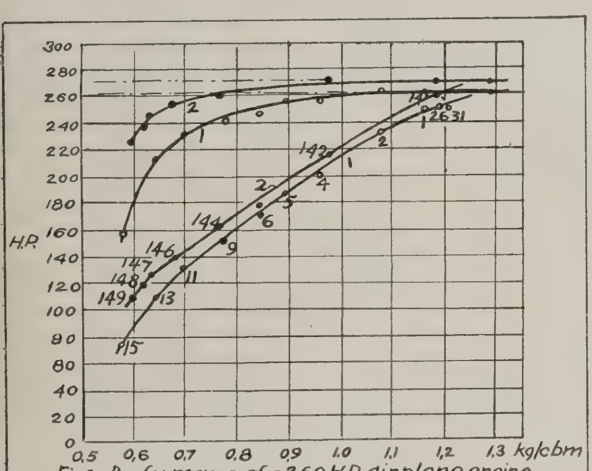


Fig 2 Preformance of a 260 H.P. airplane engine at 1450 R.P.M. relative to the air density.

air. If the power of the motor were proportional solely to the density, that is, the pressure and the temperature of the outer air, then all the measured qualities plotted against the density of the air would result in horizontal lines, for instance, converted from b = 760 mm. barometer reading, and t = 15° to

$$N_r = N \frac{760}{b} \frac{273 + t}{273}$$

Actually, however, they are curves with a marked downward course. Their deviation from the horizontal thus represents a means of measuring the altitude properties of the engine.

These disadvantages of the aeroplane engine were of course soon recognized; the remedy was, however, not introduced until a comparatively late date. Our adversaries were also strenuously engaged with this question.** By improving the carburetors, especially the so-called altitude carburetors, the decrease of the power was made to substantially keep pace with the decrease of the density of the air. By raising the ratio of compression of the engine from between 4.6 and 4.9 to 6.6, and by the improvement of the thermal efficiency which was thereby brought about, an improved adaptation of the aeroplane engine to the altitude conditions was secured. In the vicinity of the ground the intake of the engine must be throttled in order to avoid self-ignition and excessive stress. As the aeroplane reaches higher altitudes the throttling is gradually decreased, and at heights of from 2 to 3 km. it finally ceases entirely. Up to this point the engine power remains almost the same. Another step in advance is made with engines of extra size, in which the displacement of the piston is increased in comparison with ordinary engines and in relation to the dimensions of the parts of the driving gear. These engines must also be throttled when near the ground in order to keep the average piston pressure so low that the power output does not exceed the nominal power. The super-compression can also be combined with super-dimension. In this way it is possible to maintain the engines at a uniform power up to an altitude of almost 4 km. Beyond this point a falling off of the power is avoided by the use of compressors of superchargers, which will be treated in detail later.

The purpose of the compressor is to furnish the engine with air of sea level density, no matter what the surrounding atmosphere may be. Up to a certain prescribed altitude there is then the same pressure in front of the carburetor as that prevailing at sea level, and for which the engine has been built.

Three general types of compressors—reciprocal, rotary, and centrifugal—may be considered for this purpose. Reciprocating compressors, as far as is known, have never been tried, as they are too heavy and the valves are too complicated.

Of the rotary compressors, those of the Wittig * and Roots types as well as compressors with revolving vanes were tried, but nothing is known as yet regarding the results. The centrifugal compressor has proved the most suitable up to the present; its construction was taken up by several factories during the last two years of the war and brought to a high state of perfection.

The compressors are, as a rule, driven direct by the engine, mostly at the end opposite the airscrew. It is true that this drive was objected to at first, as it was feared that the crankshaft would be endangered by torsion vibrations. However, these fears have so far proved unfounded. In the case of aeroplanes with several engines, giant aeroplanes especially, the compressor or supercharger is driven by a special engine and in that case furnishes the air for all the engines. For the aeroplanes with several engines in a central plant there is also a good solution of the problem. In the latter case the common supercharger can be connected directly with the central plant. As to whether individual supercharges or one common supercharger is better, also whether the drive from the central power plant or from a special motor is to be preferred, has not yet been decided. Each arrangement has its advantages and disadvantages. With single engine aeroplanes there can of course be only the direct drive from the engine. With giant aeroplanes carrying a large service crew, the drive from a special engine is better adapted to the air requirements at the various altitudes, as it is then always possible to give the compressor engine the number of revolutions corresponding to the air requirements at any given time. The compressor that is coupled with the main engine or with the central plant has, on the contrary, always the same multiple of the number of revolutions of the main engine; it therefore generates pressures which are too high for the lower altitudes and the discharge must be throttled. Thus the amount of energy required for the compressor and the temperature of the compressed air attain their maximum near ground level, and as it is in the lower air strata that the highest natural temperatures predominate, the compressed air reaches the carburetors in a very heated condition at the lower altitudes. Although experiments have shown that most aeroplane engines can stand temperatures even above 100° C. in front of the carburetor perfectly well, at least for short periods, nevertheless this heating of the fresh air results in a considerable drop in power output. In order to compensate for the latter and in order to generate the driving power for the compressor, it is necessary to furnish the engine with air at greater pressure than sea level. This causes an overload which is, however, unimportant for the short time necessary for the take-off and for climbing the first few thousand meters.

Fig. 3 shows how the engine may be overloaded by the supply of fresh air under high pressure. In these experiments the charging pressures immediately in front of the carburetor amounted to 830, 760 and 720 mm. Hg. (curves 1, 2 and 3), the temperatures of the fresh air, also directly in front of the carburetor, were 40°, 30°, and 8°, the exhaust pressure was unaltered, 736 mm. It is evident that slight pre-compressions are sufficient to secure remarkable power increases and to provide the extra energy for the driving of the supercharger connected with the engine.

The mistaken conception, entertained not only by aviators but also by the engine manufacturers, that the engines are permanently overloaded by the superchargers because of the considerable gain of the aeroplanes in climbing rate and ceiling, must be contradicted here. As long as the pressure in

* "Technische Berichte der Flugzeugmeisterei," Vol. III, 1918.

** Compare "Zeitschrift 1918," p. 61, 816; Engineering, June 28 and July 5, 1918.

* Compare "Zeitschrift 1918," p. 61. 816; Engineering, June 28 and July 5, 1918.

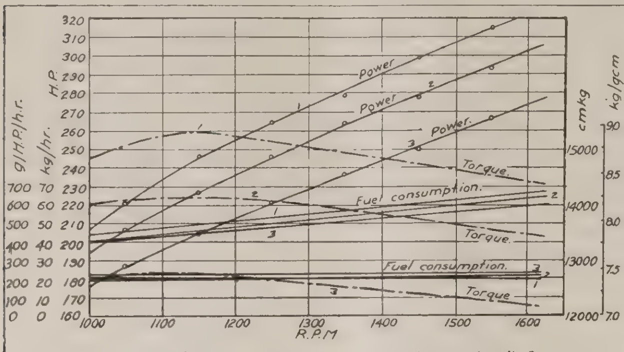
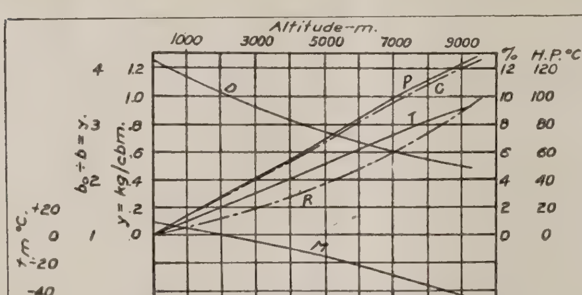


Fig. 3 Power, torque (also mean working pressure in a different unit of measure) and consumption of a 260 H.P. airplane engine for three different charging pressures and temperatures before the carburetor with increasing number of revolutions. (Upper consumptions curves are for kg/hr, lower for g/H.P./hr.)

front of the carburetor is not increased above the pressure at ground level, the engine works mechanically and thermodynamically under the same conditions as on the test stand or in the aeroplane near ground level. If, however, the altitude up to which the compressor furnishes the full pressure is exceeded, the power of the engine falls off in the same way as occurs with the ordinary engine at its start from the ground. The purpose of the compressor is to raise the flying altitude of the aeroplane. When the flying is done at these altitudes, the loading of the engine in the vicinity of the altitude limit is exactly as high as with the motor without compressor, only with the difference that the aeroplane is now at a considerably higher altitude.

The power of an engine with compressor is also somewhat increased by another cause, not involving a correspondingly increased absolute piston pressure. The reduction in the pressure of the outer air causes the exhaust back pressure to be diminished, the engine furthermore works under air pressure during the suction stroke, thus converting the delivery of the compressor into useful work. These two circumstances increase the useful piston pressure, and consequently the power output, at the altitude of 5,000 m. to the extent of almost one atmosphere or about 12.5%.

In order to calculate the power required for the supercharger, Fig. 4 may be used. As the superchargers are not cooled and in consequence of their small dimensions, substantial losses in the clearance of the impellers, in the pressure compensation, and in the stuffing boxes, must be taken into account, with the result that the compression curve is a polytrope lying above the adiabatic curve. For the purpose of a general survey, the compression ratios for $\frac{b_0}{b}$ for the various altitudes are also plotted. The values of b have been taken from Table I. Fig. 4 also shows the expenditure of power



D = Air density.
P = Power required for adiabatic compression of 1 kg/sec.
C = Compression power ÷ engine power X 100.
T = Rise in temperature Δt with adiabatic compression.
R = Compression ratio = $b_0 \div b$.
M = Mean yearly temperature t_m.

Fig. 4. Power consumption of the supercharger.

for the adiabatical compression of 1 kg/sec. of air having an initial temperature corresponding to the mean yearly temperature t_m.

The output of aeroplane engines (when referred to the piston displacement) amounts, generally speaking, to from 1 to 1.1 h.p. per liter, the inducted weight of the air from 3.5 to 3.6 kg. per h.p./hr. From this we get the expenditure of energy with adiabatic compression of the fresh air in relation to the output of the engine at the various pressure ratios or altitudes. The actual expenditure of energy is increased by the losses in supercharger and drive. Detailed tests with a supercharger built by Brown, Boveri & Co. in Mannheim for 1,100 to 1,200 h.p. engine output (that is, a delivery of about 4,200 kg/hr. and a pressure ratio of 1.2) had an efficiency of 65% referred to the adiabatic curve and converted to —15° initial temperature. With later models 68% was attained, even with smaller quantities of air.

The addition of the pressure connection does not, for the most part, require any substantial alteration of the engines, so that their standardized production is not interrupted. The most favorable engine for the purpose is the 260 h.p. Daimler engine. Its one-piece carburetor and common air suction tube made possible the immediate attachment of pressure connection. It was only necessary to consider whether it would be more advantageous to take the air from the atmosphere direct or through the engine crankcase passage. With the 260 h.p. Daimler engine the air is inducted through a channel under the crankcase, and then through a quarter bend to the carburetor in order that it will be heated and that oil draining off into the oil sump will be cooled. The temperature of the inducted air is raised 15° to 20° above the temperature outside. This results in raising the final temperature of compression in the supercharger. As, with the supercharger in operation, the air is more than sufficiently heated in consequence of the compression; even with the very lowest outside temperatures, it seems advisable to take it direct from the atmosphere as is done with all other engines. With the 260 h.p. Daimler engine this was, however, not possible at first because when the weather was warm the air current alone was not sufficient for cooling the crankcase. The lubricating oil in it was heated to between 85 and 95° C., became too thin, and did not reach the piston pins. This was remedied by circulating the oil through an oil cooler by means of a gear pump driven from the camshaft by a flexible shaft, the cooler forming a part of the engine housing.

The air reaches the carburetor direct from the pressure connection. The carburetor itself needs no alteration as long as the ground level pressure to which it is adjusted is not exceeded to an appreciable extent. The space above the float, or the float chamber overflow, also the container from which the carburetor directly receives the fuel, are to be connected with the pressure pipe of the supercharger by a compensating tube, as the same pressure must prevail above the float and in the fuel tank as at the pressure connection of the supercharger. All the carburetor openings must be closed so that no leakage of fuel is possible. A light detachable cap is fitted over the float valve stem guide. The guides of the inlet valves are always sufficiently airtight so that no special provision is necessary at that point. In order to render back firing harmless it is advisable to fit relief valves of generous size in the piping between the pressure connection of the supercharger and the carburetor. The wall between the last two stages of the super-

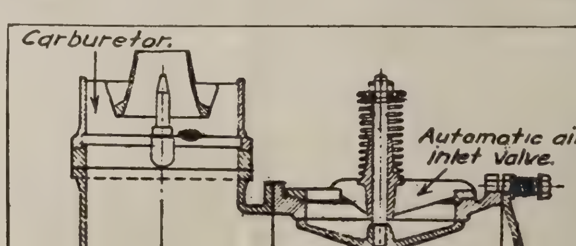


Fig. 5. Compressed air relief valve for a 260 H.P. airplane engine.

charger is, above all, endangered during violent back firing. In the case of one common supercharger for several engines, each engine has a connecting piece (Fig. 5), usually an aluminum casting with a large blow-off valve (a cap held in place by several springs), a throttle valve for shutting off the compressed air (missing in Fig. 5), and an automatic air suction valve. The suction valve permits the intake of air direct from the atmosphere as long as the supercharger is not working; when, on the contrary, the supercharger is furnishing air of higher pressure than that outside, then the valve closes. The connecting piece is connected to the float chamber by a pressure compensation tube. Special attention must be given to the fuel discharge. The utmost care must be taken to prevent an overflow of fuel at the nozzle from running into the tube connections (which in giant aeroplanes are built into the lifting surfaces and are of considerable length), as during back firing they might explode and endanger the aeroplane. For this reason the connecting piece is provided with a fuel drain cup having a drain cock or small opening so that the misplaced fuel can drain off. The loss of air thus occasioned is unimportant. An open U tube filled with mercury is the most suitable means for measuring the pressure of the central superchargers. On it is a millimeter scale which shows the different pressures appertaining to the various altitudes. For single superchargers on small aeroplanes, low pressure gauges are used, which show either the absolute pressure or the pressure in excess of the pressure outside. In the first case the pressure of the air in front of the carburetor is always adjusted to one atmosphere. In the second case the regulation for the various altitudes is according to a special graduation of the altitude indicator.

(To be continued)

THE ANSALDO LIMOUSINE

THE Ansaldo Limousine, the first model of which was recently brought to America by the Aero Import Company, is a very interesting post-war commercial machine with a remarkably good performance. In its first distance flight here, the machine was flown for the Ralph C. Diggins Co., from New York to Chicago by Pilot Bertram in less than eight hours flying time.

The Ansaldo 300-C, the official name of the model, is a single-motored biplane with a central fuselage specially designed for passenger carrying. The pilot's seat is on the same level as the passengers and the windows are so arranged that the visibility is excellent.

The passengers who made the trip from New York to Chicago were enthusiastic about the comfort of their journey, and it is certain that the machine will be popular with the aerial journeyers in the middle west.

Specifications

Span	44′ 07″
Height	9′ 06″
Length	31′ 06″
Surface	475 sq. feet
Ceiling (with full load)	16,000 feet
Climb in 15 minutes	7,000 feet
Weight (empty)	2,530 lbs.
Normal Useful Load	1,700 lbs
Permissible excess load	250 lbs.
Maximum speed	120 M.P.H.
Cruising speed	100 M.P.H.
Landing speed	43 M.P.H.
Motor	300 Fiat

Interior arrangement of the Ansaldo 300-C Limousine

Side view of the Ansaldo Limousine which made the journey from New York to Chicago in 7½ hours flying time

U. S. AIR MAIL PRIZE AWARDS

George W. Lewis, executive officer of the National Advisory Committee for Aeronautics, on May 18th sent out one thousand dollars ($1,000.00) in prizes to the three winners in the Transcontinental Air Mail Contest.

The prize money was donated jointly by five newspapers, namely:

The Omaha *Bee*,
The Salt Lake City *Tribune*,
The San Francisco *Examiner*,
The Chicago *Tribune*,
The New York *Evening Post*.

The contest opened September 8, 1920, the date of opening the last lap of the Transcontinental Air Mail route, and ended March 8, 1921, six months later. Mr. William C. Hopson of the Chicago-Omaha Division was the first prize winner and received five hundred dollars ($500.00). Mr. Christopher V. Pickup of the Omaha-Salt Lake City Division won second money, three hundred dollars ($300.00) and Edson E. Mouton of the Salt Lake City-San Francisco Division gained third prize, two hundred dollars ($200.00).

This Contest came about as a result of former Second Assistant Postmaster General Otto Praeger's interest in the performance of the pilots on this tremendous air route, his desire to offer some incentive to the pilots to make a splendid record, and his desire to bring about some form of public recognition of meritorious services. This plan found ready response on the part of the Manufacturers Aircraft Association, and on the part of the Contest Committee of the Aero Club of America. The contest was open to all Air Mail pilots flying between New York and San Francisco, and the funds were donated by the five newspapers above mentioned, each being located at one of the principal cities served by this route.

William C. Hopson, winner of first prize

Conditions met in the practical operation of postal aircraft were considered in determining the basis upon which awards were to be made, and it was finally decided that awards would be made to the pilots totaling the greatest mileage on completed trips made at the rate of eighty miles an hour or better; failure for weather conditions or motor trouble not being a factor. On this basis pilot Hopson made 111 trips for a total mileage of 23,778 miles. Pickup, 103 trips for 22,651 miles, and Mouton 102 trips aggregating 21,240 miles. Other trips were made by these pilots but only those counted which from start to stop were maintained at or better than the scheduled speed of the Air Mail Service which is eighty miles an hour.

Christopher V. Pickup, winner of second prize

Considering these performances as merely routine work in the Air Mail it will be readily seen to what practical success the Post Office Department has brought the Air Mail pilots. Nine other pilots were runners up in the contest, varying from 91 down to 54 trips, with a mileage from 19,255 to 11,388 miles.

The awarding of the prizes was finally placed in the hands of the National Advisory Committee, and Mr. Lewis was selected as final referee. The striking feature of the competition lies in the fact that the three winners were flying over the three most recently established routes in the service. Pilot Hopson, who took first prize, was flying between Chicago and Omaha, across the state of Iowa as well as part of Illinois and Nebraska. Pilot Pickup, winner of the second prize, flew eight hundred mountainous miles from Omaha to Salt Lake City across the states of Nebraska, Wyoming and part of Utah. Pilot Mouton, winner of the third prize, flew over the desert country between Salt Lake City and Reno, Nevada.

William C. Hopson, who took first prize, was born July 5, 1887, at Hill City, Kansas. He served four years in the U. S. Navy, two years as a Quartermaster, and during the World War was a Lieutenant in the Army Air Service, having 758 hours in the air to his credit; was stationed at various Army Fields throughout the United States, and was an instructor in cross-country flying. He entered the Air Mail Service November 26, 1919.

Christopher V. Pickup was born in Moline, Illinois, July 16, 1896, and prior to entering the Air Mail Service was a pilot and Assistant General Manager of the Durant Aircraft Corporation, Oakland, California. He served seven years in the Army, two of which were in the Army Air Service, where he reached the rank of a Lieutenant. He is credited with 1150 official hours in the air during the war. Pickup enrolled in the Air Mail Service August 25, 1920.

The third prize winner, Edson E. Mouton, was born in Sacramento, California, December 10, 1894. His pre-war aviation experience included demonstrating and testing for the Fowler Airplane Company, in San Francisco, and after the war he was with the Durant Aircraft Company of Oakland, California. He was a Lieutenant in the Army Air Service and had over 400 hours flying time during the war, graduated from the American Pursuit School, Issoudun, France, from the French Aeronautical School, Fort Brin, France, and was a test pilot in the Air Service of the A. E. F. He entered the Air Mail Service on the 18th of August, 1920.

Edson E. Mouton, winner of third prize

HOW TO ESTABLISH AN AIRWAY

1. The problem of airway development in the United States has assumed such proportions that it is now necessary to formulate plans for the development and expansion of these routes. With this idea in view there is now being established an airway between Washington, D. C., and Dayton, Ohio, which, it is anticipated, will serve as a model for the creation of other airways that are now planned. This model route is 400 miles long and traverses territory of such varied characteristics as to enable the collection of data which will prove to be fundamental in the extension of this work, and, incidentally, it connects the Office of the Chief of Air Service with the Engineering Division, Air Service, at Dayton, Ohio. These airways

will be open under proper legislative control to any operators or owners of aircraft.

2. The following is an outline of the general organization for a model airway.

A. Towns 200 miles apart will be designated as main stations and should have the following equipment:
   1. A municipal landing field adequate for the needs of all types of aeroplanes and for the use of all operators, commercial, Government, and private.
   2. Markers:
      (a) White circle 100 feet in diameter (band 4 feet wide) to be placed in the center of landing field.
      (b) International identification markers to be placed on the right-hand side of every railroad track where it enters the town.
   3. Wireless station which shall include telegraphic, telephonic, and direction-finding apparatus.
   4. Meteorological station which will forecast and record weather conditions, wind directions and velocities at different levels, disseminating the above information to fliers along the route.
   5. Hangars, gas and oil filling station, and repair shop.
   6. Small rest hut equipped with telephone and toilet facilities.

B. Towns 100 miles apart will be designated as substations and should have the following equipment:
   1. Municipal landing fields.
   2. Markers (same at all landing points).
   3. Wireless station.
   4. Hangars, gas and oil filling station, and repair shop.
   5. Small rest hut equipped with telephone and toilet facilities.

C. Towns 25 miles apart will be designated as intermediate stations and should have the following equipment:
   1. Municipal landing fields.
   2. Markers (same at all landing points).

D. All other towns of importance (this shall particularly include county seats, railroad centers, junctions, and intersections) lying on either side of the airway and within a radius of 20 miles should have the International Identification Marker.

NOTE.—The exact location of main stations and substations will often vary, depending upon the nature of the country and other existing conditions. It will also be impracticable in certain parts of the country to have a landing field every 25 miles.

3. As these airways are for the use of all operators or owners of aircraft the various municipalities should establish and maintain the landing fields, because the benefits which enure accrue to the local community most directly and local National Guard and Reserve units could train on these fields.

4. The Boy Scout organization which is cooperating with the Air Service will be asked to construct the international identification marker, emergency field markers, and submit monthly reports on emergency landing field conditions, guard wrecked planes, and generally assist aviators in trouble.

5. These airways will promote commercial aviation, be an important transportation factor in the progress of civilization and be available for national defense. The Air Service, in acting in an advisory capacity, merely essays to provide information through its fund of experience so that the establishment and organization of fields and markers may be systematic and uniform throughout.

Specifications for Municipal Landing Fields

1. *Location.*—The field should be situated as near the heart of a town as is practicable so that too much time will not be lost going to and from the field. It should also be near a car line with electric power and water available.

2. *Size.*—There are three different shaped fields—first, the L-shaped, each leg being about 900 yards long and 300 yards wide; second, the square field, which is about 700 yards square, and third, the oblong field, which is 900 yards long and 400 yards wide. The oblong field should parallel the direction of the prevailing winds. The above dimensions may seem excessive and many pilots have landed and taken off in a much smaller space; however, the main point to consider is the saving of life and property. A missing motor on the take-off out of a small field will often result in the loss of both. The cost of two or three wrecked planes would easily pay for the extra ground required.

3. *Character of ground.*—The ground must be firm under all weather conditions, which necessitates a good drainage system. The surface must be level and smooth, as a rought, uneven field wil cause considerable injury to the aeroplane landing gear. A sod field is very desirable, as it eliminates a great deal of dust, which is not only very disagreeable but extremely injurious to the working parts of an aeroplane motor.

4. *Approaches.*—Surrounding obstacles, such as high buildings, telephone lines, trees, etc., decrease the amount of field available for landing. Trees at either end of the field should be cut down and telephone lines removed or placed under ground.

5. *Marking.*—After the field has been inspected and approved by the United States Air Service pilot it should be marked with a large white circle, 100 feet in diameter (band 4 feet wide), which is placed in the center of the landing area and must be flush with the surface of the ground.

The marker is best constructed by digging out a trench four to six inches deep, filling it with crushed rock or other material brightened up by whitewashing or painting frequently, so that it can be readily seen from a great height. The name of the town should also be laid out at one end of the field in large letters. A wind indicator such as the standard aviation wind cone should be placed at one corner of the field about 30 feet above the ground, preferably on the hangar if there is one.

6. *Accommodations.*—Municipal landing fields must provide communication by telephone, transportation facilities, gasoline, oil and sundry supplies. Hangars and workshops will be needed as the use of the field develops.

Emergency Landing Field

An emergency field can be any field that has a hard, level surface free from obstacles. It should be about 400 yards long and 200 yards wide and is marked with a white cross in the center.

International Identification Marker

The international identification marker is to be placed on the right-hand side of every railroad track where it enters the town, and will be an invaluable aid to aerial navigation in making it possible to read the latitude and longitude from the ground.

The following will best illustrate the value of such markers: A pilot has become lost or bewildered because of a low fog or otherwise and flies in some direction until he picks up a railroad track; he follows this railroad until he sights one of the identification marks, which is located on the right-hand side of the track, and on the outskirts of the city. He immediately locates himself and will not have to pass over the heart of the city, thus endangering his own life and the lives of others by hitting some high tower or building hidden by a low fog.

Material for the marker should consist of heavy stones (cobblestones suggested) and must be whitewashed frequently so that the diagram can be readily seen from a great distance.

The railroad right of way or a vacant lot adjacent to the railroad would be the logical location for the diagram. In case of one railroad the diagram will be placed on the right-hand side of the track and on each side of the town, so that it can be read by the flier from his right as he approaches the town. Two railroads would necessitate the laying out of four diagrams. In other words, there should be two diagrams for each railroad, so that a flier following any railroad into the city can locate himself immediately.

This of course is the ultimate ideal, but if it is impracticable at this time to construct more than one of these diagrams, preference should be given to the north or east side of the town.

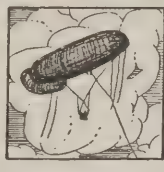
The diagram is in the form of an open-sided rectangle whose short sides shall be oriented north and south. This open-sided rectangle represents the lower (south) or upper (north) half of the rectangle formed on the map by the lines of latitude and longitude. The rectangle represents a unit sheet of the local aeronautical map covering an extent of one degree of latitude and one degree of longitude, the long side, oriented east-west, representing a parallel of latitude and the short sides, oriented north-side, representing meridians of longitude. Within the open rectangle a dot is placed representing the approximate relative position of the marker with respect to the limiting lines of latitude and longitude.

To the left and right of the diagram numbers are placed, that to the left representing the latitude and that to the right the longitude of the southwest corner of the diagram.

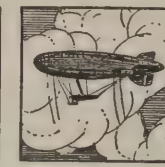
For example, if your town is in the rectangle whose south and west sides are formed by the lines 39° latitude and 80° longitude, respectively, then your diagram will have 9 placed on the left and 0 on the right.

The last number in each case is considered sufficient because the points 29 and 70 or 49 and 90 are approximately 600 miles away on either side and the aerial navigator will not be confused as to their identity, for he generally knows where he is within much less than 600 miles.

The name of the town should be laid out at the top or bottom of the rectangle, depending on the case in hand. Letters should not be less than 4 feet in hight, for they must be discernible at a great distance. The sides of the open rectangle should be 3 feet broad; the long side (parallel of latitude) 49 feet, the short sides (meridians of longitude) 32 feet in length; numbers 9 feet high.



FOREIGN TECHNICAL DIGEST



The R-36

R-36, now disguised under the civil registration marking G-FAAF, is complete.

R-36 was designed by the Admiralty in 1918, and construction was started by Beardmore, Ltd., at their works at Inchinnan early in 1919. Construction has been delayed owing to the unsettled policy of the Admiralty in regard to airships, and upon their decison not to complete the ship for service purposes she has now been completed for the Air Ministry as a passenger-carrying ship.

Generally similar in form and construction to the R-34 class, R-36 is of appreciably larger size and of greater power. She is fitted with six cars, five being power eggs, and the sixth is a combined passenger and control car.

Of the power eggs, two are forward wing cars, each fitted with a 260-h.p. German Maybach, two are amidships, abreast of the center of the passenger car, and carry each a Sunbeam "Cossack" of 350 h.p., and the fifth is well aft on the center line. This last car contains one 350-h.p. Sunbeam "Cossack" engine. Bow mooring attachments are provided to suit the type of mooring mast developed by the British Airship Service.

The most interesting feature of the ship is the accommodation provided for passengers. The passenger car, which is connected to the ship's structure amidships, is a framework built of duralumin girder work of generally similar structure to that used in the framing of the ship proper. It is 131 feet long and has accommodation for 50 passengers. This car is very considerably wider at the top than at the bottom, and is divded up into cabins by heavy curtains, which can be drawn back during the daytime.

At the top of each "cabin" are two folding bunks, and on the ground a table and two comfortable wicker chairs. Windows are fitted to each side giving to each passenger a clear view outwards. A central gangway runs down the car, between the cabins on each side.

At the center of the car is fitted a cooking galley and pantry, together with lavatory accommodation.

In addition to the passenger accommodation there are the usual quarters for the crew, fitted in the central keel gangway of the main structure, above the passenger cabin. The crew provided for consists of four officers and twenty-four men—captain, first and second officer and engineer officer, two coxswains, seven riggers, thirteen engineer ratings and two wireless operators.

Allowing a margin of fuel for adverse winds, and for the weight of food, water and other necessary stores, R-36 will be capable of carrying 30 passengers, each with 100 pounds of luggage, and one ton of mails, from England to Egypt in about 72 hours. For shorter journey the useful load capacity is, of course, greater.

The main particulars of R-36 are given below:

Specifications of R-36

Length	672 ft. 2 in.
Diameter	78 ft. 9 in.
Height overall	91 ft. 7 in.
Volume	2,101,000 cub. ft.
Gross lift	63.8 tons
Total h.p.	1,570
Maximum speed	65 m p h
Cruising speed	50 m.p.h.
Disposable lift (fuel and freight)	16 tons
Wt. of fuel consumed	0.65 tons per 100 m.

(*Aeroplane*, March 30, 1921.)

The Zeppelin Dornier C-3

The Do-C-3, as the new machine is styled, is an all-metal monoplane with fairly thick wing section. A peculiarity, which the Do-C-3 shares with the previous monoplane flying boat, is that, although the wing is of deep section, it is tapered neither in chord nor in depth. The consequence is that it has not, apparently, been found possible to make it a true cantilever wing, it having a pair of struts on each side to support it. Aerodynamically it is an advantage to taper the wing, as a fairly high L/D ratio can then be obtained while still retaining a fairly high maximum lift. Such a tapered wing, however, is more expensive to build than is a parallel one, and possibly it is this fact which has influenced Herr Dornier in his choice of wing form.

Constructionally the wing of the Do-C-3 is interesting on account of the fact that it is built of metal throughout. The framework of the wing is in steel, while the covering is stated to be sheet Duralumin. Although this covering does undoubtedly strengthen the wing, no account of this has been taken in stressing the machine, and the covering is merely intended to act as a means of maintaining the exact curvature of the wing, it having been found that in high-lift wings quite minute changes in curvative may sometimes have extraordinary great influence upon the aerodynamic properties. The wing is without dihedral, and is built in one complete unit from tip to tip, the center of the wing resting on the top of the cabin. Bracing is by means of four streamline section steel tubes, two on each side, running to the lower *longerons* of the *fuselage*. Owing to the considerable depth of the body, the angle of the bracing tubes is very good. Small *ailerons* are fitted near the tips, and the cranks, etc., for operating the *ailerons* are buried inside the wing.

The tail plane is also of approximately rectangular plan form, and is a cantilever structure of simlar construction to that of the main plane. The elevator is divided and unbalanced. The rudder, on the other hand, has a balance portion projecting forward above the fixed vertical fin. Tail planes and control surfaces are also covered with aluminium alloy.

The fuselage is a steel structure covered with Duralumin, and is very deep in front, the engine being mounted fairly high, and the center of thrust only slightly below the level of the wing. The cabin is aft of the engine, from which it is separated by a fireproof bulkhead. Seating accommodation is provided for six passengers, who enter the cabin through a door in the starboard side, direct from the ground, without needing any steps, the floor of the fuselage being exceptionally low over the ground. Windows are provided in each side of the cabin, and as the wing is above the cabin the passengers obtain an unobstructed view of the ground. It is pointed out that as the machine is intended to a great extent for use over the beautifully scenery of Switzerland, this is a great advantage. Great attention has been paid to the prevention of fire on board, all fuel tanks being situated in the wings, outside the body.

The pilot is placed aft of the cabin, his cockpit being located just aft of the trailing edge of the wing. Here, it is claimed, he obtains a very good view, as he is on a level with the trailing edge, and can thus look over or under the wing at will.

Perhaps one of the most interesting features of the Do-C-3 is the undercarriage. This, it will be seen from the accompanying illustrations, is in the form of two short wing roots totally enclosing the wheel axle, with a disc wheel at each end. It would be difficult to imagine a simpler undercarriage, and although the structure is probably fairly heavy, as it almost necessarily must be in order to take the loads from the wheels at the ends of the two short cantilever wing roots, the resistance should be quite small.

The engine fitted to this machine is a 185 h.p. B. M. W. over-dimensioned, high-compression six-cylindered motor, which is one of the best examples of modern German engine design. It is very economical in fuel, even when running throttled, while the effect of the design is to enable the engine to maintain its full power up to a height of about 10,000 feet. The normal power for cruising is 200 h.p. at 1,400 r.p.m., while for short periods, such as for getting off, the engine can be revived up to 1,500 r.p.m., when it develops about 240 h.p. As the machine is fairly lightly loaded per square foot of wing surface, she is said to get off well and to have a good climb, while requiring only a short run for getting off.

The following are the main data relating to the Do-C-3: Span, 55 ft. 9 ins.; length, o.a., 29 ft. 10 ins.; height, 8 ft. 3 ins.; chord, 9 ft. 10 ins.; wing area, 506 sq. ft.; weight, empty, 2,420 lbs.; useful load, 1,600 lbs.; weight, fully loaded, 4,020 lbs.; load per sq. ft., 7.95 lbs.; load per h.p. (on 200 h.p. basis), 20 lbs.; maximum speed, 105 m.p.h.; cruising speed, 80 m.p.h.; ceiling, 16,500 ft.; fuel consumption, .45 lb./h.p./hour; oil consumption, .022 lb./h.p./hour; range, about 400 miles. (*Flight*, March 31, 1921.)

New Italian Seaplane

The Italian S.I.A.I. Company are building a new type of seaplane which has the following dimensions:

Span	12 m.
Total length	9 m.
Total height	3.50 m.
Surface	34 sq. m.
Weight (empty)	800 kgs.
Useful load	430 kgs.
Speed	220 km. p.h.
Engine	1 Ansaldo E.28, 450 h.p. fitted with 1 four-bladed driving propeller.

This seaplane will be known as the S-19, and is really only a larger and stronger copy of the S-13. In addition to the aforesaid machine, the S.I.A.I are constructing the S-22, which will be fitted with two Isotta-Fraschini V-6 260 h.p. engines. Both this and the S-19 are to enter the Monaco International Competition. (*Aeronautics*, March 31, 1921.)

NAVAL and MILITARY AERONAUTICS

Final Plans for Bombing Tests

Secretary Denby authorizes the following:

Final plans for the bombing, by the Navy and Army aircraft, of the battleships and other surface types of Naval vessels were completed this morning at a joint conference of officials of the Atlantic Fleet, the Navy Department and of the Army Air Service.

The bombing experiments will start June 21st with the bombing of an ex-German submarine, the U-117, which will be followed on June 28th by a search problem and an accuracy of bombing test on the radio-controlled battleship Iowa. The Army has withdrawn from this second phase of the joint operations all of its land planes, and will use only the seven seaplanes it obtained from the Navy and four airships or blimps which it possesses. The other operations against the ex-German destroyers, the ex-German cruiser Krankfurt, and the ex-German battleship Ostfriesiand will be conducted about 60 miles east of Cape Charles lightship where there is 60 fathoms of water.

In these the Army will participate with the Navy, using bombs ranging from 200 to 2,000 pounds. In these tests also, the Army recommended they be conducted within 30 miles of shore, but the Navy considered this to be impracticable. The Atlantic coast slopes in depth along this portion of the seaboard.

The communication arrangements were also completed, so that both the Army and the Navy aircraft can communicate by radio at all times with the shore bases at Hampton Roads and Langley Field and with the surface ships in the vicinity and so that also they can talk among themselves in flight on the radio telephone.

The exercises themselves will be conducted under the direction of the Commander-in-Chief of the Atlantic Fleet, Admiral Henry B. Wilson, and this conference today has brought to a close the final arrangements for participation of the Army in the event and the coordination of their units.

Brigadier General W. Mitchell has been ordered by the War Department to the command of the Army Air Force at Langley Field which will participate in the bombing exercises.

The Navy Air Forces will be commanded by the Commander of the Atlantic Fleet Air Forces, Captain A. W. Johnson, U. S. Navy, with headquarters on the U.S.S. Shawmut, and the Base Commander, Captain S. H. R. Doyle, U. S. Navy, at Hampton Roads, will be in charge of Operations at the Base.

The Shawmut will take station at the targets in the case of the ex-German ships, and at about the center of the scouting area in the case of the Iowa experiment. She will make weather reports and transmit necessary orders and information from the Force Commander to the Base and Scouting Force. In the case of the ex-German ships, rescue ships will be provided by the Navy between the base and the target, intervals between these vessels not being greater than ten miles.

Owing to the uncertainty as to the location of the Iowa until after contact has been reported, it will be impossible to provide a line of rescue vessels between the ship and the base, but surface ships will take assigned positions as soon as possible after the contact is made.

The German ships will be at a point about fifty miles east of Cape Charles Lightship, which is 13 miles east of Cape Charles Light. The Iowa in the zero hour will be at some point between the latitude of Cape Hatteras and Cape Henlopen, 50 to 100 miles off shore steaming toward shore with the idea of reaching the coast before she is located and bombed by aircraft.

Navy air boats and Army dirigibles will form a scouting line between the two Capes and will scout to the eastward for a distance of 100 miles off shore, or until contact is made with the Iowa.

The schedule for the bombing is as follows:

On July 15th the battleship Force Destroyer Operator Squadron will be in the Southern Drill Grounds and the Air Forces concentrated at Chesepeake Bay. The first experiment will be on June 21st against the U-117, by the Air Forces of the Army and the Navy. On June 28th will be the exercises against the Iowa. On the 1st of July the Battleship Force Destroyer Operative Squadron will proceed to New York for the holidays, returning to the Southern Drill Grounds on July 11th. On July 13th will be the experiment against ex-German destroyers. On July 18th the experiment against the ex-German cruiser Frankfurt, and on July 20th the destruction of the ex-German battleship Ostfriesland.

The Navy Department has arranged to turn over to the Army the obsolete battleship, Alabama, for such experiments as the Army Air Service may desire to make. The Alabama will be turned over as soon as she has been stripped of salvaged equipment and materials. The Navy has been invited to participate in these experiments and has accepted.

30 Cadets Volunteer for Forest Fire Patrol Duty

Pursuant to instructions from the Air Service Officer, Ninth Corps Area Headquarters, San Francisco, about 30 graduate cadets, who have volunteered for forest fire patrol duty during the summer months, will proceed at various intervals to Mather Field, Sacramento, for assignment to duty. The instructions suggest that such cadets as possible be ferried via aeroplane in ships which are being flown from the repair depot at Rockwell Field, San Diego, to Mather Field, and which land at this field for gas and oil en route. They also may make the trip in any other manner which will not obligate the government for costs of transportation.

Bombing Events at Aberdeen Proving Ground

In a recent item attention was invited to a record of 25,855 pounds of bombs dropped at Aberdeen Proving Ground by four aeroplanes on three days, April 4th, 5th and 6th. During the past week a new record was made. "B" Flight with four aeroplanes and an operating personnel of six officers on April 19th, 20th and 21st dropped 231 live bombs for a total weight of 46,550 pounds. The record day was April 19th when 18,400 pounds of bombs were dropped in spite of the fact that due to delays in loading and fusing the bombs the first ship left the ground at 10:08 A.M.

Very apparent progress is being made in the development of the .05 delay fuse which is planned will be used in the battleship bombing of Project "B." A large number of bombs are being dropped in the deep water channel of Chesapeake Bay as a test of these fuses.

In the channel above a white cross has been anchored as a target. After each load of bombs has been dropped a group of fishing boats hasten toward the cross to pick up what fish have been killed. As the next aeroplane approaches the fishermen withdraw from the cross and the short distance that they withdraw is an index of their confidence in the accuracy of the bombing. A speed boat is kept on the go constantly to prevail upon the fishermen to retire farther in order to preclude any possibility of accident.

As a matter of mere academic information it may be stated that fragments of a 600 pound bomb dropped from 2000 feet and functioning instantaneously have been observed to travel some 1200 yards. Eight of such bombs were dropped at a ten foot cross in the water on a routine function test and the maximum error from the center of the cross was less than one hundred feet.

Naval Aviation Orders

Lieut. Comdr. E. E. Wilson to connection fitting out U. S. S. Wright and on board when commissioned.

Lieut. J. B. Kneip to post-graduate course in aeronautics, Naval Academy.

Lieut. W. R. Fleming to post-graduate course in aeronautics, Naval Academy.

Lieut. C. H. Havill to post-graduate course in aeronautics, Naval Academy.

Lieut. H. Schmidt to post-graduate course in aeronautics, Naval Academy.

Lieut. A. Laverents to duty Atlantic Fleet, Shipplane Division.

Lieuts. J. R. Kyle and F. M. Mail to Naval Air Station, Pensacola.

Lieut. J. M. Shoemaker to Naval Air Station, Pensacola.

Lieuts. D. L. Conley and A. M. Pride and Lieut. (J. G.) W. B. Gwin to duty Atlantic Fleet Shipplane Division.

Lieut. P. A. Gillespie to duty Atlantic Fleet, Shipplane Division.

Airship Pilots' Instruction

The Chief of the Air Service has authorized a board to convene at Langley Field, Va., to consider the question of a proper course of instruction for airship pilots. The board will also make recommendations relative to the necessary changes in existing orders covering airship training. The board is composed of Major John A. Paegelow, president; Capt. William O. Butler and Lieuts. Byron T. Burt and George W. McEntire.

FOREIGN NEWS

The Brennan Helicopter

Although given far less publicity than those of the French and other experimenters, the experiments of British "helicopterists" have been progressing during more than a year, and certain remarkable results have been attained. Thus it will come as a surprise to many that the helicopter has actually been shown to be capable of very high horizontal speeds, a feature with which this type of machine is not usually credited. The reason is, however, not far to seek. There is little surface to offer resistance to horizontal motion, the airscrew blades that are traveling from front to rear during the rotation of the screws tending to counteract the resistance of those moving forward, although naturally unable, owing to the forward movement of the whole machine, of quite doing so. Among our most advanced experimenters is Mr. Louis Brennan of monorail fame, whose machine has for a considerable period been at Farnborough, where the experimental work has been carried out. It is to be presumed that, being actually installed at "the factory," Mr. Brennan has had valuable assistance from the wind tunnels and whirling arm, and one therefore supposes that those set in authority incline to the opinion that "there is something in it." Whatever the fate of the Brennan helicopter when it is tested in flight shortly, the knowledge gained from the experiments should serve to indicate whether it is worth while to proceed along these lines or not.

The Gottenborg Air Station

The Gottenborg municipal authorities have decided to apply to the Swedish Government for permission to expropriate certain land in the parish of Torslanda on the island of Hisigen, for the purpose of laying out an air station.

Dutch Air-Post Charges

The extra charges for the International air-mail service, the Dutch Postmaster-General announces, will be for Belgium 10 cents (*2d.*); Great Britain, Ireland, France, and Germany, 15 cents (*3d.*); Denmark, 25 cents (*3d.*), all per 20 grammes (about ¾ oz.).

The Concours Militaire

Lieut. Gonin continues to plod along on his three-engined Farman Goliath, covering his 500 kilometres a day. On April 21 he was troubled with rain, but managed to complete his flight. He is expected to complete his last stage any time now.

Plane Fails to Win 100,000 Francs

PARIS.—The biplane Goliath, piloted by Lieutenant Bossoutrot, completed half the circuit of the Grand Prix of the Aero Club of France for a prize of 100,000 francs, landing at Pau at 12:40 o'clock this afternoon. Bossoutrot telephoned the club May 22 that he had been compelled to land at Tours and abandon the flight.

German Plane Problem Up

PARIS.—The question of how to control German commercial aeroplanes so that it will be impossible readily to transform them into instruments of war again was taken up by the Council of Ambassadors May 22. Hugh C. Wallace, the American Ambassador, was present at the meeting.

Aerial Surveying in India

Following on the announcement that a survey of the Orinoco delta is being undertaken by the Bermuda and West Atlantic Aviation Co., we see that the Survey Department of the Government of India has issued a paper which deals with some experiments in aerial surveying which have been made out there, and draws conclusions therefrom. To test the utility of the aerial camera a mosaic of the city of Agra was made, but the survey experts concluded that "nothing is to be gained by adopting the air method for normal one-inch surveys of the plains of India." This conclusion can be easily appreciated. The report goes on, however, to consider the problem of surveying large areas of densely wooded hill country, of which there are many in India and Burma, and for these the use of the aerial camera is recommended. It is sometimes important that these tracts should be accurately surveyed for mining or forestry purposes, but the expense of surveying from the ground is very high, and indeed, when minor details are needed, it is often prohibitive. The aerial survey, in fact, seems to be the only practical method.

The Survey of India report naturally dealt with broad principles and mainly from the point of view of the surveyor who wants a map. The aeronautical side of the question is also of great interest. An officer of the Royal Air Force was employed for the experiments, and there is a danger that such a very official Government as that of India should never go further than consulting the Service men. Able as these officers are in their own work, one cannot expect them to look at commercial and industrial matters from the same impartial point of view as men who have devoted themselves to the study of civil flying. In this case it is to be hoped that the Government of India does not intend to risk the lives of pilots unnecessarily by sending them in ordinary Service aeroplanes to fly over "large areas of densely wooded hill country." Such work should be reserved for special multi-engined aeroplanes which can be guaranteed immune from forced landings. Or, again, the semi-rigid airship, about the suitability of which for India we recently published an article, may prove a success out there; and if so its power to fly slowly not far above the level of the earth should make it particularly suitable for survey work. In wooded country which is not hilly, but where smooth water abounds, such as the Sandarbans (*i.e.*, the delta of the Ganges and the Brahmaputra) and some parts of Burma, the seaplane or flying boat may prove the best craft. The Orinoco expedition will soon provide data for deciding that point.

Japan Multiplying Pilots

From Tokio news is sent that the Japanese authorities are very busy accumulating pilots. From the different schools it is stated an average of 36 pilots every 5 weeks are being turned out as efficient, it being arranged that the supply of machines keeps pace with the personnel available.

Ricci Company on a New Design

From Lucrino it is reported that the Italian Ricci aeroplane works are to be employed upon the construction of machines entirely different from those hitherto produced, as regards design and construction.

A New Latécoère Passenger Machine

From France it is reported that the Latécoère firm at Toulouse have nearing completion a large passenger machine which will accommodate 20 passengers. No details are available regarding the new machine. Incidentally, it might be mentioned that the firm, which is running a service between Toulouse and Casablanca, has changed its name from *Lignes Aériennes Latécoère* to *La Compagnie Générale d'Enterprises Aéronautiques.*

Meteorological Expedition to Jan Mayen

A geophysical expedition is to be sent this summer to Jan Mayen to make investigations in connection with the storms which break out over Northern Europe through the gap between Iceland and Spitsbergen. Sufficient funds have been obtained to cover the expenses of the expedition and money is now being raised to cover the expenses of establishing a W√T Meteorological Station on Jan Mayen.

Norwegian Military Air Service

It has been decided to equip the Norwegian Military Air Service with flying-boats as well as aeroplanes. Military flying-boat bases are to be established at Kristiansand and Bergen, where the Naval Air Service already has bases. The two services will as far as possible cooperate, but will own and use their own machines.

Night Flying Tests

A Handley Page aeroplane carried out further tests of the night flying lights at the London terminal aerodrome, Croydon, between 10 and 12 o'clock last Thursday night. Flying from Biggin Hill, the aeroplane, piloted by Captain Roach, R.A.F., landed at Croydon, and taking as passengers several airway lighting experts, took off along the beam of a searchlight, and after a short flight landed with the same assistance.

As a result of the recent tests by airship and aeroplane it has been established that the aerial lighthouse at Croydon is visible over a radius of 30 miles and the cone light at 25 miles, while at 20 miles' range the aerodrome searchlights can be clearly seen.

German Commercial Flying Statistics

The Berlin *Stock Exchange Journal* of March 14 publishes the following figures of the results during March of the "Deutsche Luft-Rederei" on the two lines in operation from Berlin to Dresden, and Dortmund:

Out of 186 flights scheduled, 183 were made, 256 passengers and 21,426 kilos merchandise being carried. The 1.6 per cent of trips not carried out were due to bad weather.

The work of the three aerial transport companies maintaining a service from Berlin to Leipzig during the period of the fair held at the latter city between March 5 and 14 reads as follows:

	No. of Passengers	Goods: Newspapers	Goods: Mail
Deutsche Luft-Rederei	107	2,100 Kg.	14 Kg.
Lloyd Air Service Sablatnig	110	......	835 "
Rumpler Luftverkehr*	58	......	190 "

* Including the figures of link flights on the line Leipzig-Nuremberg-Munich, alternatively Augsburg of 28 passengers and 9 kg. mail.

The circular joy rides over the neighborhood of Leipzig are not included.

German Aircraft and Indemnification Figures

The following communication addressed to the "Ilük" (International-e Luftfahrt Uberwachungs Kommission—*i.e.*, Aircraft Control Commission), has been published: "The Allied request for payment of a further sum of 25 million marks as indemnification for sales of aircraft, due to the Allies, may be settled from the following account of all aeroplanes and aero-engines that have been made in Germany since 1911:

	Engines		Aeroplanes	
1911-1914	1,778		1,954	
1915	5,029		4,474	
1916	7,823		8,179	
1917	12,029		19,423	
1918	16,412		14,356	
1919	1,215		.....	
Total		44,286		48,386
War consumption	5,500		26,000	
Supplied to Allies abroad	484		1,000	
Supplied to Neutrals abroad	686		.....	
Reduced to produce	3,000		.....	
		9,670		27,000
Rest at armistice time		34,616		21,386
Surrendered at armistice	2,600		2,600	
Left at the front (estimation)	2,500		3,000	
Surrendered or destroyed	27,590		14,001	
Consumed in German revolutions and in Baltic	300		500	
Admitted for German air traffic	169		149	
Available at Kiel national yard	120		.....	
		33,297		20,250
Rest not made out		1,337		1,136
Number paid for with 50 million marks		1,000		1,000
Remain to be paid for		337		136

These latter figures do not only include aircraft that may have been exported, but also the material which has so far been withheld from discovery inside Germany. The German Foreign Office has asked the President of the Inter-Allied Control Commission for information whether this account be recognized. If further information is required the German Government has declared itself ready to pay at once the amount of 25 million marks, reserving definite settlement, according to the request in the note of January 25, in compensation for the machines that have been exported or are hidden in Germany beyond the number of 1,000 machines that have already been paid for.

ELEMENTARY AERONAUTICS *and* MODEL NOTES

CLUBS

PACIFIC MODEL AERO CLUB
240 11th Avenue, San Francisco, Cal.
Portland Chapter: c/o J. Clark, Hotel Nortonia, Portland, Ore.

PACIFIC N. W. MODEL AERO CLUB
921 Ravenna Blvd., Seattle, Wash.

INDIANA UNIV. AERO SCIENCE CLUB
Bloomington, Indiana

BROADWAY MODEL AERO CLUB
931 North Broadway, Baltimore, Md.

PASADENA ELEM. AERONAUTICS CLUB
Pasadena High School, Pasadena, Cal.

NEBRASKA MODEL AERO CLUB
Lincoln, Nebraska

BUFFALO AERO SCIENCE CLUB
c/o C. Weyand, 48 Dodge St., Buffalo, N. Y.

ILLINOIS MODEL AERO CLUB
Room 130, Auditorium Hotel, Chicago, Ill.

SCOUT MODEL AERO CLUB
304 Chamber of Commerce Bldg., Indianapolis, Indiana

MILWAUKEE MODEL AERO CLUB
455 Murray Ave., Milwaukee, Wis.

MODEL AERO CLUB OF OXFORD
Oxford, Pa.

CAPITOL MODEL AERO CLUB
1726 M St., N. W., Washington, D. C.

AERO SCIENCE CLUB OF AMERICA
Beach Bldg., E. 23rd St., New York City

AERO CLUB OF LANE TECH. H. S.
Sedgwick & Division Sts., Chicago, Ill.

LITTLE ROCK MODEL AERO CLUB
1813 W. 7th St., Little Rock, Ark.

Releasing Parachutes From Models

Spectacular parachute exhibitions may be staged by models equipped with releasing devices by means of which parachutes are dropped during flight. Although these manoeuvers were successfully tried out some years ago, there are many refinements in detail that provide a wide field for investigation and sport in this line. Parachutes are now a common equipment for large aeroplanes and parachute leaps are a daily occurrence. Great interest shown in the opening up of a parachute at a great height and its slow return to earth are features which can be duplicated by almost any type of model aeroplane properly equipped.

Parachutes for this purpose vary from 6″ to 12″ in diameter. China silk is the best material to use, but silk fibre paper works well although not quite so durable. The chute may be housed in a streamline container attached to the framework. This container, which may be of aluminum, serves to keep the chute in correct position so that when it is released the threads (to which a counter weight are attached) do not become tangled. The releasing device must be worked out for the particular type of model to which it is attached. One method is to provide a wire located below the rubber elastic in such a position that when the elastic becomes unwound its weight rests on the wire which connects with a trip releasing the chute. With this device, the parachute is released just as soon as the model begins its downward glide after the rubber motive power is unwound. A little ingenuity on the part of designers will disclose many methods by which the releasing mechanism can be made to act.

Another means of releasing the parachute is by suspending it from the framework by means of a thread to which a short fuse (such as is used on fireworks and flash-lights, etc.) is attached. Before the start of the flight the fuse is ignited and when it burns to the thread, the parachute is released. This method has the advantage of making it possible to have the release occur at any predetermined time, for the fuse can be lengthened or shortened according to the time that release is desired.

This fuse releasing method has been used with good results in dropping small smoke-bombs. Experiments with small smoke-bombs showed where it was possible to vary the moment of dropping as well as the moment of explosion. The fuse may be timed so as to cause the bomb to ignite while it is attached to the machine (causing probable disaster to the model), while it is falling toward the earth, or after it reaches the earth. All this is done by varying the length of the fuse before it reaches the releasing thread and again after it passes the releasing thread to the bomb itself. Model builders experimenting along these lines are urged to observe considerable caution in handling powders of various kinds and are especially advised to use but very small quantities of any selected. A good open space should be chosen for such experiments in a place where no possible harm can come to spectators.

Opportunity for Texas Model Builders

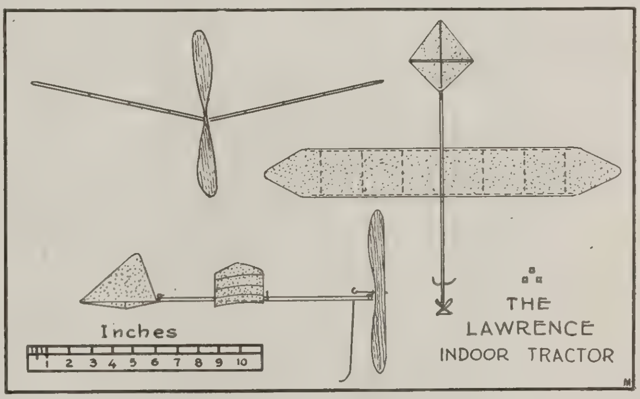
Starkey Duncan, Jr., of Stamford, Texas, who is an ardent follower of aeronautics, is desirous of joining or participating in the organization of a model club in his vicinity. Mr. Duncan reports that there are no model clubs within 100 miles of his town, in spite of the fact that he believes there are sufficient enthusiasts near him to form such a club. Builders of models in this region have a splendid opportunity for building up a live club in Texas, a state in which flying has played an important part for many years. Anyone interested in such a club should communicate with Mr. Duncan or with Aerial Age.

The Lawrence Indoor Tractor Model

One of the most successful indoor models ever flown in an Illinois Model Aero Club contest was built by Mr. Lawrence, a member of the Club. The model is of the tractor type and was constructed especially for indoor contests. One of the conditions imposed in this contest was that the length of the rubber was to be not more than 10″ in length. This was done in an effort to make the models more nearly uniform.

Mr. Lawrence has succeeded in building a small machine which has flown for as long a duration as many outdoor models. In the winter contests the Lawrence model consistently flew in the neighborhood of the ninety seconds mark and in one of its flights was officially timed for 103 seconds.

The propeller, motor base and wing beams are constructed of balsa wood. The propeller is 9¾″ in diameter and has a 9″ pitch. The landing skid, wing tips, ribs, tail spreader and vertical fins are of bamboo. The wings and tail are covered with undoped silk tissue paper.

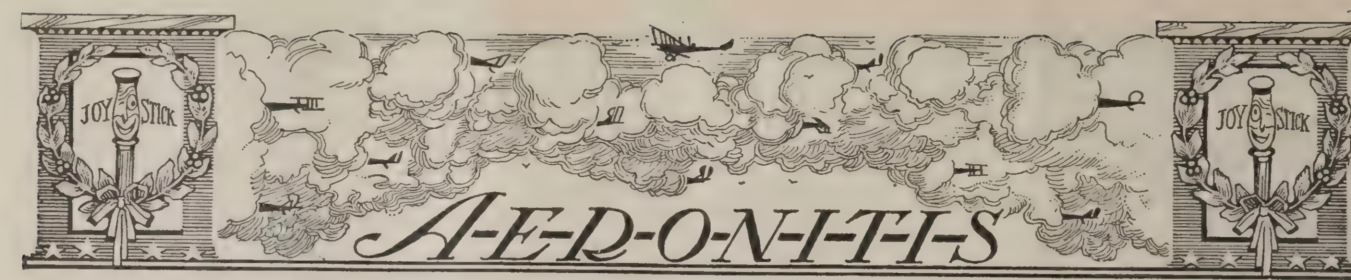


The weight of the model is nine-hundredths (.09) of an ounce, one of the lightest successful models on record. The light weight was made possible by the use of balsa wood and a series of small wire hoops on the motor stick. By passing the rubber elastic through these hoops the motor base can be lightened to a remarkable degree without impairing the strength. The motive power consists of only a single strand of ⅛″ flat elastic.

At the beginning of a flight the model climbs at a steep angle until it reaches an altitude of about 20 feet above the ground. At this height it flattens out and drifts, rather than flies, very slowly in large circles until the power is expended. The elastic can be wound up about 1,000 turns. The propeller revolves at about nine revolutions per second. In spite of the light weight of the Lawrence model, it is reported to be capable of withstanding all ordinary handling.

This model is not the lightest model entered in the Illinois Model Aero Club's contests, for one even lighter has been constructed by Mr. B. Pond whose model weighs only .06 ounces. In the above mentioned contest the heaviest model to compete was one weighing .19 ounces. All these models flew around not less than 90 seconds.

Verifying the weights given for the models mentioned above, a letter from Mr. Warren De Lancey, Chairman of the Publicity Committee of the Illinois Model Aero Club, assures us of their correctness.



"Shall I Not Fly?"

Shall I not fly? My spirit has confest,
Spirit of forebears long since passed away
Longing for flight unceasing, freed from earth,
Of all man's longings, loveliest and best—
Shall I not fly?

Shall I not fly to realms of air afire,
And every effort use to mount on high;
Up above beasts and lower men who live
Far from the goals of flight and man's desire?
Shall I not fly?

Shall I not fly, a virile, vital mind,
Winged like a greater bird in heaven above;
Worlds and more worlds to conquer and control,
Soaring and striving perfect worlds to find?
Shall I not fly?

Should I not fly the very heavens would ring
With condemnation loud and sentence long,
Ambitions thwarted, aspirations gone
And all the peopled skies man's doom will sing,
Should I not fly.

Empty as yet the zenith of our dreams,
Empty and free from man and all his kin,
Free for the mind, no longer mind enchained,
For man in space and flight high destiny beams;
Shall I not fly?

HAROLD A. DANNE, in the *N. Y. Times.*

The Airwaymen of 1979

(Being the Report of J. O. Flynn, Chief Radio Operator, Halifax Airport. 7 A. M. July 9, 1979. As told by his assistant Tom White.)

Jerry Flynn, chief operator for the Halifax field of The Trans-Atlantic Airline Company, brought his feet down off the table with a thump and grabbed a pencil and wrote in a very excited manner the message that he was receiving.

"Listen to this, Tom!" he said, as he turned to his assistant: "On board *Condor* 4 A. M., ten hours out of Paris, 500 passengers on board including special messenger with five million dollars worth of radium. Small 600 horsepower biplane of the old 1960 type Amphibian landed on our top wing and with its crew of five men held up our pilots and motor-room and robbed all passengers of valuables and the special messenger of radium. Made their way to their own machine and took off with about ten million dollars worth of valuables. We turned our discharge apparatus on them as soon as they were in the air and tried to discharge their batteries and force them into the sea, but failed. Robber bearing off to north toward Canada. Easily identified as the old 1960 biplane, amphibian style, with one motor and crew of five men. If your discharger fails on their batteries, tell your charging station to refuse recharge and watch for their landing. *Condor* expected in Chicago about noon. Please notify Chicago and Paris any information. Signed Nav'g Officer, *Condor.*"

"Isn't that a dandy," said Jerry; "I wonder if the *Condor* has run into one of the old-time buses equipped with something new in the line of discharge-proof batteries. You know, Tom, I have been expecting that for the past year now. However, you had better run over to the charging station and tell them to keep a sharp lookout, and read this wire to them. And Tom!" called Jerry, as the latter was leaving the room, "have McGinnis send up three of those 60-hour battery machines whenever any one calls in for a recharge. We may be lucky enough to catch the airwaymen."

Jerry settled back in his chair with his receivers on his head and picked up a paper to read, becoming interested in the report of yesterday's Cincinnati-St. Louis game, when he caught "H. S., H. S., H. S.," which was his station. He laid down the paper, picked up a pencil and wrote: "Tune in charging station for 600 H P. motor, 25-hour battery, altitude eight thousand, batteries good for only thirty more minutes. Am due Winnipeg one o'clock. Charge to East Coast Airline Co. Ship number ten."

Jerry jerked off his receivers and rushed out to McGinnis. "Mac, push those three new 60-hour buses into the air at once! Drive the machine that is coming in at eight thousand down on this field if possible, for I am sure it is the machine that robbed the *Condor.*"

Twenty minutes later, four machines slowly circled the Halifax field and, sure enough, one of them was an old type amphibian biplane which landed nicely and came to a dead stop near the center of the field. Jerry, Mac and I and several of the mechanics, each with an automatic in his hand, ran out to the machine just as the door of the stranger opened and its occupants stepped out. They totaled an even five and were immediately told that resistance would be useless. Jerry walked to the machine and climbed inside, finding a closed bag which he brought outside and opened and found that it contained several huge rolls of English and French money, many pieces of jewelery and three large tubes of radium.

Speed

How does this suit you, Mark?

"My Choice"

If, from this world of wondrous treasures,
I might choose just one thing—
Then with "True Good Love" fill up my measure,
And leave me alone to sing.

Alone with my Love, for-ever and aye,
While others choose their lot—
To sing and dream till the close of day,
In some secluded spot.

And then at last, when Father Time,
Shall put us all to the test—
When the gold is sorted from the grime,
Who will have stood it best?

Centuries ago the same stars shone,
With the same indomitable might,
So "Real True Love," still claims its own,
Down the stream, to Eternal Light.

Mrs. Speed.

"Say pop, we have an Army of 200,000, haven't we?"
"Something like that."
"Well, when are we going to have another war?"
"Not until we've gotten rid of that Army, my boy."—*New York Sun.*

AERIAL AGE WEEKLY

L. 13, No. 13 JUNE 6, 1921 10 CENTS A COPY

©Fairchild Camera Corp.

Airscape of Section of New York Harbor Showing Congestion of Shipping due to Engineers Strike

The Curtiss Aeroplane and Motor Corporation After the War

LISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
riptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce In London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIII NEW YORK, JUNE 6, 1921 NO. 13

THE PRESS ON THE AEROPLANE DISASTER

WHEN the official investigation of the wreck of the Curtiss-Eagle aeroplane, in which seven lives were lost, is held, experts should be put on the stand to give their opinions about the construction of the various types of machines, foreign and domestic, now being used in this country. Particular attention should be given to those of wide span and great weight, designed to carry several passengers. Brigadier General William Mitchell, assistant chief of the Army Air Service, maintains that the lesson of the disaster is that a central bureau or department to control aviation should be created. He argues that if there had been a radio service under the direction of such an organization Pilot Stanley M. Ames could have been warned in time of the movement and intensity of the storm in which the Curtiss-Eagle was destroyed. But it is high time that the construction of aeroplanes was regulated so that only machines satisfying standards based upon experience were allowed to go up.

It is said that there is nothing to deter any individual from designing a plane and attempting to fly with it, although it may have defects that official inspection might detect. Certification of machines is just as necessary as examination and registration of pilots. In the War and Navy Departments the opposition to a single aviation organization is so strong that its advocates have made little headway, but there should certainly be a Federal law of the air. State legislation can never be adequate. There should be a comprehensive law for the forty-eight States, and it would be well to put the drafting of it into the hands of recognized specialists and authorities. Fatal accidents have been so frequent of late—nineteen in the mail service alone in the past year—that a way must be found to increase the margin of safety. Obviously, sane and sound construction comes first in importance.

One lesson there plainly is in the loss of lives which were so valuable to the Government and the country: Flights should be forbidden during violent electrical disturbances. General Mitchell and other army officers, while flying lighter machines than the Curtiss-Eagle, were near sharing the fate of Colonel Archie Miller and his companions on Saturday, owing their escape, it is held, to keeping away from the vortex of the tempest. It is General Mitchell's judgment that any machine, passenger-carrier or single-seater, would have been wrecked at the centre of the storm.—*New York Times.*

THE testimony of Capt. de Lavergne, Air Attaché of the French Embassy at Washington, is the most important so far to be had regarding the causes of the loss of the army ambulance plane with the lives of all seven of its occupants.

This is enough to justify a full official inquiry. With all of the immediate witnesses dead, it can apparently never be established whether or to what extent the violence of the electrical storm into which the plane ran was responsible for its tragic smash to earth. But if the plane was "badly balanced" and thus poorly conditioned to fight a storm we ought to know it. The army and the country will also want to know how widely such a condition of aircraft engineering is prevalent in that branch of the service.

It was the observation of French experts at the time the United States entered the war that the American Air Service showed a lack of skilled constructive engineering. This was its chief fault. Whether it still lingers in army aeroplane-building and what has been or is being done to overcome it is a matter demanding the strictest official scrutiny.

—*New York World.*

THE accident near Washington which resulted in the sudden death of seven noted airmen, when the aerial ambulance in which they were flying was caught by a treacherous wind and crashed to earth before its pilot could regain control, has once more brought vividly to the attention of the country lessons that have been persistently ignored. These are:

First—The need of a unified government department controlling all aeronautical enterprises and placed in the hands of practical experts in aeronautical science and active aviators.

Second—The need of uniform aerial laws for the country, based upon the international air navigation convention which the Wilson Administration refused to ratify.

Out of details gleaned from witnesses of the disaster it is clear that it could have been obviated had the machine been sufficiently high in the air to enable Lieutenant Ames, its pilot, to complete the maneuvers necessary to regain control. The unfortunate pilot cannot in any way be blamed for not flying at what would in this case have been a safe altitude, because he had not been warned that the terrific storm which struck the flying ambulance was expected.

For more than two years, men actively interested in aviation have been urging the establishment of a separate department

(*Concluded on page* 307)

The News of the Week

The Aeroplane Disaster

Washington—In the worst accident in the history of aviation in the United States seven men, five of them army officers and two prominent civilians, were killed when a big Curtiss-Eagle ambulance aeroplane, caught in a violent electrical and wind storm over the Potomac River, crashed to earth near Morgantown, Md., forty miles south of Washington, shortly after 6 o'clock on May 28. Not a single occupant of the plane survived and it was not until today that the Army Air Service was able to learn what had happened to the machine and its passengers.

The dead are:

AMES, Second Lieutenant STANLEY M., of Washington, pilot of the plane.

BATCHELDER, A. G., organizer and Chairman of the Executive Board of the American Automobile Association and formerly editor of *MoToR*.

BLUMENKRANZ, Sergeant RICHARD, mechanic in the Air Service.

CONNOLLY, MAURICE, formerly a member of Congress from Iowa, a Major in the Air Service during the war, and at the time of his death sales manager of the Curtiss-New York Airplane Company.

McDERMOTT, Second Lieutenant CLEVELAND W., of Langley Field.

MILLER, Lieut. Col. ARCHIE, Air Service, General Staff College, who had charge of all the American plans for the handling at Mineola of the British dirigible R-34 in July, 1919.

PENNEWELL, Second Lieutenant JOHN M., of Langley Field.

The big ambulance aeroplane and four smaller craft left Bolling Field early Saturday morning for a round trip practice flight from Washington to Langley Field. Those flying the aeroplanes and the guests aboard the Curtiss-Eagle made the trip also to witness the review of the fully organized air brigade which is to take part in the army and navy bombing tests off the Virginia Capes late in June. Langley Field is 140 miles in an air line south of Washington.

The Curtiss-Eagle was under the command of Lieutenant Ames. In addition to Mr. Connolly, Mr. Batchelder and Lieut. Col. Miller, there were aboard as guests Representatives Philip P. Campbell of Kansas, Representative Joseph Walsh of Massachusetts and Captain Guy de Lavergne, Air Attaché of the French Embassy at Washington. Representatives Campbell and Walsh and Captain de Lavergne made the return trip to Washington by night steamer from Norfolk.

At Langley Field two other passengers, Lieutenants McDermott and Pennewell, both of whom were formerly stationed at Kelly Field, Texas, were taken on board for the return trip to Washington.

The big aeroplane had been stripped of its ambulance accommodations for this trip, and seats had been provided for the passengers.

The distance of 180 miles down the valley of the Potomac past Mount Vernon, Gunston Hall and other historical Colonial homes, was made without mishap by the ambulance aeroplane.

The aeroplane had covered 120 miles of the return trip before running into the storm, which nearly played havoc with four other army aeroplanes, including one in which Brig. Gen. William Mitchell, Assistant Chief of Air Service, was engaged in a round trip flight between Bolling and Langley Fields. The returning planes were in the vicinity of Indian Head, Md., where one of the naval proving grounds is located, when they ran into the storm.

The terrific electric storm was solely responsible for the accident.

This is the finding of the special board of investigation appointed by Major M. F. Scanlon, commanding officer at Bolling Field, after a survey of the wreck.

Capt. W. C. Ocker, who fought his way around the same storm, following Brig. Gen. Mitchell, Assistant Chief of the Air Service; Lieut. Paul C. Wilkins and Lieut. Leroy Wolfe constitute the board. They submitted a verbal report, and after another meeting will present a written report with their findings to Major Scanlon.

The board found upon close examination of the shattered remains of the big plane that the controls were still intact, with wires attached. In its judgment the crash was due to a sudden down current of air which drove the plane to the ground.

The examination indicated that the plane was not more than 150 feet above the ground when the current struck it, giving Lieut. Stanley M. Ames, its pilot, no leeway in which to get out of the drop.

The three officers offer no criticism of the fact that the plane was at so low an altitude at the time of the crash. The field in which the wreck was found was a fairly good one for a landing, and Lieut. Ames probably was seeking to effect one when the sudden down current caught his plane and smashed it flat on the ground.

The indications are that the Senate Committee on Military Affairs will make an independent investigation of the accident.

An investigation undertaken will have for its purpose not so much the fixing of blame for the accident, but rather to devise some method by which the number of accidents can be reduced to a minimum.

It is certain that the accident will greatly stimulate interest in Congress in aviation, and efforts probably will be made to pass legislation bringing all branches of aviation under some form of central control.

In a measure Congress has become apathetic with regard to aviation, and when it comes down to placing the army, the navy and other air services under a single head there is always such wide difference of opinion in Congress, as well as in the army and navy, as to prevent definite action.

Victor Emmanuel III, King of Italy, talking to Major James E. Chaney, Air Service, of the American Embassy, Rome. On right of the King and without hat is Nobile, the famous Italian dirigible expert and builder of the Roma

Gen. Mitchell is anxious to have the Senate investigate the accident and the subject of aviation fatalities in general. He thinks that such an investigation would be most helpful in disclosing the confusion now existing in aviation in the United States and the absolute necessity for a definite policy involving some form of centralized national control.

"The accident to the Curtiss Eagle exemplifies the necessity for a national organization of aviation," said he to-day. "Every other big country has tackled the air problem from the standpoint of the air without regard to other services. On the other hand, we are still going along much like we did before the World War.

"In order to develop efficiency, however, we must have a system of airways. Modern planes alone will not suffice. An airway simply means a series of aerodromes, or landing fields, placed along a marked route, and equipped with wireless and meteorological apparatus. In order to be effective, weather bulletins must be furnished every hour and all arrangements made for both day and night flying.

"Without day and night flying, commercial aviation in this country will be impossible. Highly organized airways are as important today and night flying, or even to straight day flying, as roads and refilling stations are to motor vehicles. The greater the development of commercial aviation the bigger the reserve for military use in an emergency and the stronger our air defense."

Washington-New York Air Mail Discontinued

The Air Mail route between Washington and New York was discontinued at the end of last month.

The reason for the discontinuance of this route is geven in an announcement of the Department as follows:

"This route has been kept in operation for a considerable length of time without serving any particular usefulness, either in connection with the mail service or in connection with experimental work, because it was felt that perhaps it would be possible to develop a long distance route between the pricipal New England cities and the large cities in the southeastern States, in which event the New York-Washington leg would be a very important part of the through route. However, our appropriations for the coming year will not permit of any such extension and there is no further necessity for our continuing the New York-Washington route as an experimental one because we have better opportunities for conducting the necessary experimental work on the New York-San Francisco route. In addition to this, of course, there is the urgent necessity for economizing and not incurring any unnecessary deficit."

Postmaster General Hays, in commenting on the discontinuance of this route, said: "This in no way is to be construed as a lessening interest in or a curtailment of Air Mail development."

Federal Regulation Urged by Aero Club and M. A. A.

The Manufacturers Aircraft Association, the National Aircraft Underwriters Association and the Aero Club of America, investigating the aeroplane accident near Paterson, New Jersey, May 20, in which two lives were lost, reported May 23 that, in their opinions, the primary cause of the crash was the absence of a Federal Aerial Law, providing among other things for the examination and registration of pilots and the inspection and certification of machines.

C. S. Jones, Chief of Flying for the Curtiss Aeroplane & Motor Corporation, flew to the scene of the accident at once. "The plane was not a Curtiss-maintained product," reported Mr. Jones. "It was one of the Army training types which had passed through many owners and which, my investigation shows, had been in at least four crashes previous to the final one. One of these accidents occurred at Monticello and two at Liberty, New York. I found that the machine had been repaired by amateurs, that several of the spars and longerons were patched, some of them in four places. It was the giving way of these spars that undoubtedly caused the wings to collapse. The plane had lain out of doors in the open field all Winter and one windstorm had blown it the full length of the field—about 1000 yards—and turned it over end. This Spring it had been hauled back to its original position and put together again as best as might be. It was never inspected by a competent person, so far as I was able to learn. I found that the owner of the flying field—who is also a flyer—had himself refused to fly this machine when the young man who took it up on its fatal trip was induced to become the pilot."

"The Paterson accident, aside from the deplorable loss of life which it cost, reacts most unfavorably and unjustly on aviation," said a statement from the Manufacturers Aircraft Association. "Commercial aviation with competent pilots and machines properly inspected and kept in repair by competent workmen, is not unsafe. Statistics show this. But the fact remains that the operation of aircraft in this country is absolutely without competent law. There is nothing to prevent an inexperienced pilot from taking up an unsafe machine with just such a result as that which occurred last Friday. The primary cause of this accident, and all others of the sort, is found in the lack of a Federal Aerial Law providing among other things for the examination and registration of pilots and inspection and certification of machines. The manufacturers of aircraft, until such law is enacted, will continue to do their utmost to maintain inspection control over machines directly produced by them; but it is physically impossible for any agency or organization outside the national government to keep track of the machines which change hands frequently and are subjected to conditions beyond commercial control. Commercial aviation in this country cannot be expected to develop as it should until an Aerial Law is passed by Congress, providing competent machinery for enforcement."

Plane Carries 23 to Atlantic City

Beginning June 15, twelve giant planes, each equipped with two motors, developing 900 horsepower, with luxurious enclosed cabins, accommodating twenty passengers, wireless operator and crew, will make hourly trips on a fixed schedule between Atlantic City and New York.

The first trial trip was made May 29 by one of the express planes, carrying twenty-three persons, including several naval officers and engineers. The passage was made successfully from New York to the Inlet in fifty-seven minutes. Landing two of the passengers here, the plane continued to Norfolk. While en route wireless messages were sent to several points and to ships at sea, answers being received without difficulty. The planes are of the F-T and F-6 type and were formerly naval express cruisers owned by the Government.

The company is the Seaboard Consolidated Air Line, headed by Stanley E. Hubbard, President, a pioneer flyer, who was at the helm during part of the initial trip.

According to the schedule which will go into effect on June 15, a plane will leave here every hour for New York City and at the same time from that point to the shore. The landing here will be at the Inlet, while from New York the planes will leave from the foot of Ninety-seventh Street.

It is also planned to send similar planes every two hours from New York to Philadelphia and every three hours to Washington.

Omaha Aero Reunion

Attorney Ralph G. Coad of Omaha, Neb., ex-first Lieutenant at March Field, writes the editor of plans for a big flying tournament at the Nebraska city the latter part of October. The event would be under the auspices of the Omaha Aero Club and would precede the national convention of the American Legion. Lieut. Coad would like to hear from some of his old "buddies" who may be interested in this aero reunion. Address him at 806 First National Bank Building.

Membership Campaign for W. B. A. C.

Mr. H. H. Robinson has been appointed Chairman of the General Membership Committee of the World's Board of Aeronautical Commissioners, Inc., and has received the acceptances of several divisional chairmen which he intends to appoint for all the states of the Union, provinces, colonies and countries of the world.

The divisonal chairmen will appoint sectional chairmen, and a general campaign for membership will be inaugurated.

It is intended to create a large membership for the purpose of assisting in the advancing of aeronautics throughout the world.

Hicks to Push Bill to License Aircraft

Because of recent fatal accidents to persons "joy riding in the air" Representative Hicks (N. Y.) has determined to push his bill providing for the Federal licensing of all aircraft.

Mr. Hicks believes Congress should enact his bill providing for the examination and registration of both pilots and planes. Hundreds of old army planes are now being used on sightseeing trips, and he stated that many accidents have resulted because no proper inspection has been made of the planes and pilots are not required to pass an examination.

Aerial Carnival at Red Oak

The Aero Club of Red Oak, Iowa, will stage a three-day aerial carnival June 23-25, and arrangements have already been completed for an extensive program. Fifteen cups and prizes, totalling over $1,000, will be offered, and most of the events are open to all comers. The Red Oak Commercial Club will furnish gas and oil free to the contestants and arrangements are also under way to provide hotel accommodations for the pilots taking part in the competition.

Calendar of Bombing Tests

JUNE 21—*Tuesday:* Bombing of ex-German sub-U117 by Army and Navy air forces jointly.

JUNE 22—*Wednesday*: Destruction U-140, U-111, UB-48 by destroyers.

JUNE 28—*Tuesday:* Search for and bombing of radio controlled battleship IOWA by Navy and Army air forces using Naval aircraft only. IOWA to be between latitude of Capes Hatteras and Henlopen 50 to 100 miles off shore at zero hour.

JULY 13—*Wednesday:* Bombing of ex-German destroyers about 60 miles off Cape Charles light-ship in 60 fathoms of water. Army and Navy aircraft jointly. If not sunk by bombs to be sunk by destroyer fire.

JULY 15—*Friday:* Destruction remaining destroyers by gunfire.

JULY 18—*Monday:* Bombing of ex-German cruiser FRANKFURT under same conditions as above. If not sunk by bombs to be sunk by big guns of fleet.

JULY 20—*Wednesday*: Destruction of ex-German battleship OSTFRIESLAND. Flyers must register at least two hits with largest bombs. If vessel still afloat to be sunk by big guns of battle fleet.

Notes: Naval air forces under command of Capt. A. W. Johnson, commanding Atlantic Fleet Air Forces, flag on U. S. S. *Shawmut.* Army air force under command of Brigadier General W. Mitchell, director of training and operations army aviation. Shore base operations under command of Capt. S. H. R.Doyle, base commander, Hampton Roads, Va. General supervision of bombing experiments in charge of Admiral H. B. Wilson, commander-in-chief, U. S. Atlantic Fleet.

U. S. S. Shawmut take station center of scouting area for *Iowa* experiment and a target in other tests.

The AIRCRAFT TRADE REVIEW

McCook Field Entertains Engineers

Dayton—Several of the S. A. E. members en route for the West Baden convention, and members of the A. S. M. E. bound for their Chicago meeting, were entertained May 21 by the Dayton Section of the S. A. E., McCook Field, and the Dayton Engineers' Club.

Given as a joint meeting of the A. S. M. E. and S. A. E., those who attended were afforded an unusually complete exhibition of all types of aircraft both on the ground and on the wing. During the entire morning McCook Field was thrown open to the engineers, who were taken on a complete tour of inspection through practically all the departments.

After luncheon at the field a technical session was held at which military and civilian members of the McCook Field staff presented a series of papers covering phases of aeroplane engineering. The evening was given over to a dinner at the Engineers' Club, where C. F. Kettering, Joseph Steinmetz, head of the aircraft section of the mechanical engineers, and V. E. C. Handley Page, were the speakers.

Twenty planes of all descriptions were lined up on the field, eight of them taking the air. Among those flying were the Junker all-metal plane, the big 1200 h.p. Caproni, and the 60 h.p. Messenger, which, with its three-cylinder engine, afforded an interesting contrast with the roaring giants equipped with two and three Liberty engines.

Members of both societies exhibited greatest interest in the radio-controlled wagon which was started, stopped and steered to left and right by wireless. The wagon is a torpedo-shaped box and its manipulation from a distant station made its movements seem almost uncanny as it would run up to a group of visitors, stop, blow a horn, ring a bell and then whirl about and start off in another direction.

The technical session proved to be one of the most interesting aeronautical meetings the S. A. E. has held. Papers were presented an aluminum air-cooled cylinders by E. H. Dix, Jr.; radio-telegraphy and telephony, by O. E. Marvel; carbureter design, C. F. Taylor; radiators, Lieut. Bayard Johnson; camouflage, C. R. Young; air-cooled engines, S. D. Herron; air photography, Lieut. E. E. Aldrin, and synchronization of propeller and machine gun fire by H. O. Russell.

Through these varied papers the engineers present were given a rapid panorama of late developments in the field of aeroplane activity. Speaking of the attempts to cast an aluminum air-cooled head on a steel cylinder, Dix stated that experiments had gone far enough to show that the idea is feasible. In effecting a juncture between the steel and aluminum various coating were used. Tinning and sherardizing were best, with advantage in favor of the latter, because the melting point of zinc is higher. Micro-photographs of steel cylinders with the aluminum head show that there is a good juncture between the two metals. After various experiments for materials to be used as valve seat inserts and spark plug bushings, low phosphor-bronze has been found best, because of the nearness of its coefficient of expansion to that of aluminum.

In making the castings elaborate care must be taken to prevent cracking. The cores in the later castings are being preheated to 500 deg. Fahr. before pouring and then the entire mold is placed in a core oven and kept at 500 deg. Fahr. for an extensive length of time. The best aluminum alloy for the purpose so far has been aluminum-silicon. Its strength falls off 2½ per cent at 300 deg. Fahr. and 20 per cent at 500 deg. Fahr. It is satisfactory within the limits of working temperature in the engine. It is also good on porosity test. The Bureau of Standards is at present obtaining data on other physical characteristics. The alloy has about 7 per cent silicon.

In discussing air-cooled engines generally, Mr. Herron stated that it is now possible to show just as good m.e.p. and output figures as with water cooled, without the disadvantage of freezing in a nose-dive. To date, 12 cylinders engines up to 240 h.p. have been built and give satisfaction. Brake m.e.p.'s of 130 lb. per sq. in. have been attained and the cylinders have been built up to 8 by 10.

Lieut. Johnson, in discussing aeroplane radiators, pointed to the depth of core possible because of high air velocity. He stated this to be the leading difference between aeroplane and automobile radiators. For the Liberty engine it is necessary to pump 73 gal. of water per min. through the jackets to meet the required minimum of 18 deg. heat range. For this reason there must be no restriction of flow.

The method of testing radiators is to climb the machine at its maximum rate and then take readings at every 1000 ft. The results are plotted curves of mean water temperature and air temperatures being drawn.

The B. G. Corporation

The name of the Brewster-Goldsmith Corporation has been changed to the B. G. Corporation, the officers of which are: August Goldsmith, president; Richard Goldsmith, vice-president; Thomas S. Mack, secretary; Arthur J. Goldsmith, treasurer.

The B. G. Corporation are manufacturers of the B. G. Spark Plug.

Wright Motor Performances at Carlstrom Field

Flight "A," Carlstrom Field, boasts of a Wright Motor with 415 hours and 50 minutes to its credit. It has been used exclusively by solo students during its entire life in the plane. This is a remarkable record for flying time on a motor without overhauling. Flight "B" at this station, some time ago, had a motor to go 407 hours before it was ordered taken down by the Engineering Department for inspection. The pilots and mechanics at this station have been handling their motors to perfection, according to above records.

Rain Insurance for Aircraft Owners

Payne & Richardson announce that they are now in a position to write "Rain Insurance" on aeroplanes, which means that it is possible for aircraft owners to take out a policy for one day, week, month, two months or three months, and every day that it rains they will pay amounts ranging from $10 to $500 per day, depending on the amount that the assured desires to carry.

It is very advantageous for carnivals, races, etc., where a large amount of money has been spent for advertising and getting the machines to a certain place, caring for the pilots, and general expenses. If a charge is to be made for field this would all be lost in case of rain, but the promoters will be reimbursed to the amount of their expenses, plus what they would have made had the race taken place.

Take, for example, an individual aircraft owner who is operating a plane from a certain field, say, Springfield, Long Island, they pay their pilot or mechanic so much per week and also have to pay for their field and hangar, probably bringing their total expenses up to $50. The rate on this amount would be approximately $3 per day, and if it rained the insurance company would pay the owner that amount, or should the owner desire to cover expenses plus his usual profit, which might amount to $50, $100 would be paid in case of rain, and for this cover the premium would be in the neighborhood of $6 to $7.

Air Service Contracts

Generators—Engineering Division, Air Service, McCook Field, Dayton, Ohio.—Bids are wanted until June 7, circular 21268, for furnishing 100 600-watt generators. For information address above.

Shock-Absorber Cord—Engineering Division, Air Service, McCook Field, Dayton, Ohio.—Bids are wanted until June 3, circular 21-267, for furnishing 15,000 feet ½-inch shock-absorber cord. For information address above.

Propeller Parts, Etc.—Engineering Division, Air Service, McCook Field, Dayton, Ohio.—Bids are wanted until June 7, circular 21-265, for 8 propeller layout plates, 8 do single, and 16 propeller protractors. For information address above.

Tool Steel—Engineering Division, Air Service, McCook Field, Dayton, Ohio.—Bids are wanted until June 7, circular 21264, for 1,450 pounds oil-hardened tool steel. For information address above.

Wrenches and Screwdrivers—Air Service, Procurement Branch, Munitions Bldg., Washington.—Bids are wanted until 2.30 p. m., June 7, circular 96, for 150 offset handle socket wrenches, 80 tee handle do, 150 do, 75 do, 400 forged steel wrenches, 100 spanner wrenches and 250 18-in. screwdrivers. For information address above.

Japs Studying in England

London—Sir Kenneth Crossley, while showing the Crown Prince of Japan over the Crossley automobile and aeroplane factories in Manchester, May 26, let escape some important details concerning Japanese aerial activity which were not generally known previously.

Sir Kenneth revealed that his firm not only has sent representatives to Japan, but that its factory is now instructing thirty Japanese in aeroplane building. The rights to build Avro machines in Japan have been granted the Japanese Government and the English plant has an order for about $500,000 worth of planes from the Japanese Government.

THE CURTISS AEROPLANE AND MOTOR CORPORATION AFTER THE WAR

By C. M. KEYS, President

IN view of the industrial, financial and political conditions, and in view also, of its record as possibly the oldest aircraft manufacturing organization of continued existence, the Curtiss Aeroplane & Motor Corporation believes it is not untimely to state definitely its policies and express its faith in the future.

Prior to April 1st no such policies could be stated, because they depended altogether upon financial considerations in process of adjustment, notably the matter of taxes and old outstanding contracts with the United States Government. Nevertheless, the corporation has, as well as it could under its limitations, followed a fairly definite policy for the better part of a year past, and is now ready and able to continue the same policy in a more definite and much more certain way. It has been greatly hampered, during the past year, by a firm resolution not to start anything which it might not be able to finish. While there is still need of caution, it is no longer necessary to make caution both the beginning and the end of its executive decisions.

The Curtiss company before the war, particularly in the days when Glenn H. Curtiss practically alone represented an aggressive American desire for a position in the air, evolved a policy which had as its ultimate aim to lead in the development of all forms of aviation. During the war the corporation was tremendously expanded, and although necessity prompted the placing of immediate needs first, never, from April 7, 1917, to November 11, 1918, was Mr. Curtiss' original idea forgotten. The readjustment which followed the Armistice brought also readjustment to the Curtiss company, the most significant features of which were adherence to the pioneer policy and the renewed activity of Mr. Curtiss in engineering counsel.

The readjustment, however, brought out some very serious limitations, which made it impossible to go on seriously with the original policy of this company. The old policy of endeavoring to lead in all development created a large number of successful types of aeroplanes and motors. In motors, for instance, the OX type and the V type were successful motors of their day, each developed by the expenditure of a very large amount of money, time and effort. In planes no aeronautical reader needs an introduction to the JN, the R, the F Flying Boat, the HS-1, the H-16, or the N-9. These types also, which, in their day, led the world in their respective fields, were developed by Curtiss at a large expense and by courageous effort and thought. It was the hope, more or less realized during the war, that by such efforts, and by such expenditures, assets would be created which might be of very great value to the people who paid for them. Only such an expectation could have justified the capitalization of a company to buy patents at a cost of $7,000,000 and the use of stockholders' funds in such development.

At the close of the war the United States Government had established its own experimental, research and development bureaus and plants, for both the army and the navy. It also adopted the idea that aeroplanes, and even aeronautical motors, should be bought only under competitive bids, with a partial exception in the case of experimental models. Both these steps on the part of the Government were probably necessary, and I have no desire to criticize them, or to suggest that they were intended to oppose a weak industry to the very powerful competition of the Government. It is, however, necessary for a clear understanding of the position of the aeroplane industry, to state that they necessarily brought about a very great curtailment of all development expenditure by the industry. It costs at least $1,000,000 to develop any aeroplane motor to the point of successful production. It is fairly obvious that no company can spend that amount of money and suffer the grief and disappointment of experimental labor—which is so often lost labor—only to have the product of that labor, if successful, taken over by the Government and thrown open to competitive bidding.

I think it is fair to say that because of these conditions, over which the industry has no control, not only the Curtiss Company but all other forward looking institutions in this art have curtailed their efforts, economized their resources, and foregone their ambitions for the art in order to adapt themselves to the policies of their Government.

The sudden ending of the war left the Curtiss companies in a peculiarly difficult position. We were operating seven huge plants in various parts of the country, employing some 16,000 or 17,000 men and women, and produced from July,

Airscape of the Garden City Plant and Flying Field of the Curtiss Aeroplane and Motor Corporation

1917, to March, 1919, a total of 5,811 complete aeroplanes, hydroaeroplanes and flying boats with spares, or more than 33 1/3 per cent of the American output during the eighteen or twenty months of the conflict. The corporation also produced more than 5,000 motors for the war. To readjust ourselves did not mean to return to pre-war status, for the art had far outgrown its previous limits. Neither did it mean continuance on a colossal scale unwarranted by the business outlook. But it *did mean* contraction to the most serviceable units and retention of additional units to care for future development.

The Curtiss Corporation's policy is to try to meet the nation's requirements in military aviation; to conduct scientific research, and to construct new commercial types according to the demand; and to aid both military and civil aviation in bridging the gap between war and peace, and utilizing, as best as may be, the equipment on hand, which must be used up before either Government or individual can take the next steps in aeronautics.

The physical establishment of the corporation consequently has been arranged as follows:

Research, Experimental and Production, planes and motors: Garden City, N. Y.; Churchill St., Buffalo, N. Y.

Rehabilitation and Overhaul: Waukegan, Ill.; Atlantic City, N. J.; Houston, Tex.

Repair and Supply Depots: Garden City, N. Y.; Waukegan, Ill.; Atlantic City, N. J.; Houston and Dallas, Tex.; Riverside, Calif.

* Flying Schools and Fields: * Curtiss Field, Garden City; *Curtiss Field, Buffalo; Curtiss Flying Station, Atlantic City; *Airport, Newport News, Va.; Waukegan, Ill.; Houston and Dallas, Tex.; Riverside, Calif.

Distributors and Agencies: Throughout the United States, Central and South America and the Philippines, thereby vastly extending the service opportunities for users of Curtiss products.

Our Garden City plant and field, adjoining the Government properties on Long Island, cover 260 acres, five of which are covered by factory buildings. The plant itself we believe to be one of the most complete establishments in the world devoted exclusively to the development and construction of planes and motors. The plant, in addition to the shops, contains a draughting department, an aerodynamical laboratory, a 7½-foot wind tunnel, a motor laboratory, including an electric dynamometer and club stands, chemical and physical laboratories, etc.

The Buffalo plant has a productive area of 179,351 sq. ft., of which 70,000 sq. ft. is sublet on short term lease so that the entire plant, with its equipment of 280 machine tools, is available for total utilization in 30 to 60 days.

The Garden City and Buffalo plants take the results of our scientific research and translate them into aeroplanes and motors of the newest types.

Before discussing production, it is necessary to revert to the general problem. The close of the war revealed a tremendous interest in flying, but no landing places, no law, no definite aeronautical policy. It left the Government with the conviction that there can be no safety for the country without aviation; but it also left a surplus of aircraft, built for training purposes, and a very distinct impression that such equipment as we had, should be utilized. And how was this to be done? This corporation tried to answer the question by taking over several thousand planes and engines, overhouling them, and endeavoring to place them in commercial aeronautics, thereby stimulating the aviation of which our national defense is in need.

Many difficulties were encountered in this program. When the original transactions began it was contemplated that the machines would be available for the 1919 market. Actually, it was well on in the summer before any were available, and the season of 1919 passed with a total of sales far below expectations. It is hardly necessary to state to the aeronautical trade what happened in 1920. The aviation market was crushed and practically annihilated by the importation and threatened importation of a very large number of British, Canadian, French and Italian machines, salvaged from war stocks.

Officials of the Army and Navy air services are convinced that an aircraft industry, strong and healthy through the gradual development of general resources is essential. Mr. Curtiss and I agree that the aircraft industry, until such general resources are developed, needs the sympathetic co-operation of the Government. Therefore work at Garden City and Buffalo assumes the dual characteristic of military and commercial. Our production facilities are now concerned mostly with small Army and Navy experimental orders. At present there are five types of modern machines being built on the floor, as well as three new types of engines.

The Curtiss policy—the development of all phases of aviation—has caused to be concentrated at Garden City all that we have thus far learned in aeronautics, and all that is being learned, day by day. Thus the types now on the floor reflect the latest progress, not only here in America, but in England, France, Germany and Italy. Our experimental work for the Government cannot be discussed fully at the present time, but it may be said that much that is welcomed as "startling" or "novel" when appearing under foreign names or circumstances, is neither "startling" nor "novel" in the work that we have in hand. We are witnessing a slow and interesting transition from wood and fabric to wood and metal or to metal and fabric, or all metal of a new alloy—a tremendous field for research. This progress is balanced, as I have said, between military and commercial types. But as the art expands, the tendency will be for military and commercial aircraft to diverge. This in turn influences production and is especially interesting as it is displacing the all-around aeronautical engineers with specialists.

It is permissible to mention briefly some of the construction under way. The *Eagle*, with one Liberty engine, is being adapted for nonstop transcontinental flying. It has also been converted into a hospital ship, carrying four litters for patients, compartments for physicians, nurse, and complete medical and surgical equipment. The *Eagle* as a bomber is fitted to carry a 2,000-pound missile. We have under way high speed pursuit craft; two-motored, internally braced monoplanes, carrying Whitehead torpedoes; two ship planes for the aeroplane carriers being developed by the Navy; night pursuit planes painted black so as to be hard to distinguish; all metal three-motored bombing planes and high speed racing planes which we expect to enter in the next Pulitzer race in Detroit.

The Curtiss Corporation has confidence in the future of commercial aviation. The Government should provide sympathetic regulation, establish airports and lay out routes, etc. The industry must do its part in providing the flyers with economical equipment and good service. Our sales campaign is based upon our general policy—the development of all forms of aviation. We have no greater responsibility than to stimulate interest among the pilots. Therefore we are selecting our distributors, wherever possible, from among pilots, and in all cases we are arranging to make each pilot a participant in the profits accruing from each sale he brings about. It is for the convenience of the pilots that we have established well equipped and stocked repair and service stations in various parts of the United States. Distributors in all sections will thus be comparatively close to some center of supply. Our aim is to give prompt service as cheaply as possible, and at the same time to assure safety.

While the newer experimental commercial jobs are under way, we believe the *Eagle, Oriole, Seagull* and reconstructed JN and Standard J-1 will provide the operator with any type of service his business requires. The *Eagle* fitted with the 400 h.p. Liberty motor, we believe to be the best commercial cargo or multiple-passenger ship. It carries ten people, with baggage; and its supply of gasoline, 250 gallons, is sufficient for a nonstop cruise of 700 miles, fully loaded. It is the most efficient weight-carrying machine of its power (over 4,000 lbs. useful load with one Liberty engine as power) yet developed. Its speed range is from 48 to 103 miles per hour.

The JN and Standard J-1 reconstructed with either the OX or C-6 motor, need no introduction or reference. As the JN became the world's foremost training aeroplane, it becomes now the pioneer commercial craft, safe, cheap, durable. The Standards, equipped with pontoon, perform the service over the water that the JNs perform over land. Both being easy to fly and easy to land in restricted areas, commend themselves especially at this time when air harbors are few and unsatisfactory.

The *Seagull* has been improved. Its three passengers now sit in wicker seats. There are dual controls, one removable. A new type of aileron assures easier control. A self-starter is now standard equipment. Special devices are installed to keep the cockpit dry, clean and free from motor oils. The hull construction has been improved. A new aluminum pigmented dope gives the wings a pleasing finish and makes them last three times as long. The new C-6 engine provides ten more h.p. or a total of 160.

The *Oriole* has been equipped with the C-6 engine, providing 160 h.p. or ten more h.p. than in the past. The seats have been staggered, giving the occupants more room. The wing area has been slightly increased and the curve changed, giving a better climb, and a considerably lower landing speed without diminishing the top speed. On cross country flights, the new *Oriole* has carried three people, with baggage, and full load of gasoline at an average consumption of eleven gallons at 88 miles per hour, which puts flying into the economical motor car class.

In conclusion: The Curtiss Aeroplane & Motor Corporation is engaged in developing all forms of aviation. It has faith in the future of the art. It believes that its present activity is contributing toward making that future a successful one, from the standpoint of the Government, the public and itself.

A TIP FOR THE AIRCRAFT MANUFACTURER AND THE PROSPECTIVE OPERATORS OF COMMERCIAL AIRCRAFT TRANSPORTATION COMPANIES

By COMMANDER E. G. ALLEN, U. S. N.

[*Aerial Age has offered an opportunity to a number of its prominent readers to contribute to current discussion of aeronautic problems through its columns, but the Editors do not necessarily coincide with all the views that may be expressed in such articles.*]

MUCH publicity has been issued on the merits of a United Air Force and what it will do for aviation development, and the average man accepts most of the claims put forward on its behalf without attempting to analyze or question them. When the aircraft manufacturer and the commercial operator likewise accept such statements without analyzing and weighing what effect such an organization will have on the future of their business, it is a curious commentary on the gullibility even of well-informed men when subjected to continuous bombarding of propaganda.

To both the manufacturer and operator of aircraft the future opens unbounded possibilities for air transportation, both passenger and freight. Expense, risk, and lack of public interest is keeping the banker, the investor, and big business men out of the game.

The industry is being carried on now on the backs of the Army, Navy, and Post Office Departments by a sort of indirect subsidy. This is bridging the gap until inventive progress and mechanical ingenuity make aviation transportation a paying proposition in the eyes of the banker and investor and until continued safety of operation and the cheapness of travel induce the public to risk and pay for such transportation.

When the American sees money and practicability in air transportation he will rapidly develop it to a greater extent than any other government or people, if let alone. This is due to our national characteristics and has been the history of railroad and automobile transportation. In neither case did we resort to government ownership, but trusted to individual initiative, ingenuity, resourceful and inventive genius to develop the game. We have brought both methods of transportation to their highest development and most extensive commercial and private use.

During and after the late war, when we were bent on experiments, we attempted the government ownership of railroads and also the government control of shipping by creating the Shipping Board. The first we considered necessary for expediting military transport ashore, the second because Congress, which had been unwilling to subsidize private shipping enterprises, and had, moreover, passed seaman laws so restrictive that they prevented American shipping from remaining in competition with foreign carriers, had found itself short of ships, making it necessary to construct a merchant fleet in war-time to transport military supplies across the seas. Both of these government enterprises ended in failure largely because of the inefficiency in and overhead carried by government departments in attempting commercial ventures in competition with private business.

The aircraft industry is now floundering in the process of development trying to prove its commercial practicability. At that, its development has been faster than any means of transportation yet devised by man, unless we except the automobile, to which it is allied in character of propulsion. The manufacturers and operators, impatient at a delay which is inherent in aviation development itself, casting about for any straw that might help support him during this period, has swallowed the nostrum of a United Air Service because it is being hawked through the press by its advocates with all the flare and promise that might attend the claims of a patent medicine for relieving the pains of childbirth.

We know what government ownership has done for us in the railroad business. Any tourist who has been abroad or any participant in the late war overseas who has seen the continental railroad service, knows how government ownership works abroad. A United Air Service is a similar proposition in air transportation. Taking a transportation system that offers unlimited commercial possibilities, you tie it down to the yardstick of a department supporting a huge corps of military officials and flyers. Appropriations made for commercial enterprise will be involved with and largely diverted into this corps, and the cement, fields, and gear necessary to support them.

The history of such departments, no matter how well they start off, is that eventually they hamper, restrict, and retard commercial progress. Given a paying commercial proposition, a manufacturer or an operator wants a free hand; he wants to be let alone to develop, expand, or contract as he desires and with the fewest restrictions possible. If any money is to be spent to further his business, he wants it spent directly, if possible, on his individual enterprise as a direct subsidy; or, if this is impossible, then spent indirectly to further it with the least possible overhead deducted from the amount appropriated.

In ocean shipping, Congress has never been willing to make a direct subsidy, but by laws protecting coastal shipping, by the assistance of the hydrographic departments of the Navy, the Coast and Geodetic Survey, the dredging of channels and harbors, the Lighthouse Service, and the building of docks, has indirectly subsidized all maritime industries.

Will Congress change its policy with respect to Aviation and make a direct subsidy? Personally, I think not; but if it did, such appropriations would be prejudiced by a United Air Service which would control the expenditure and absorb large amounts of it in military overhead.

If not direct subsidy, will indirect subsidy occur? Yes. It is occurring now by means of the military departments. Further indirect subsidy can best be made by medium of an aeronautical bureau in the Department of Commerce where appropriations for the specific purpose of aiding civil aviation will not be mixed up with or diverted for military purposes, or to maintain a huge corps of military flyers. The overhead will then be at a minimum, as it will be carried largely by existing governmental departments.

Should a United Air Service be formed, I predict the following cycle of operations, which I think are already taking place in Great Britain where a United Air Service was formed in wartime to meet a particular existing strategical situation and where it has now been carried over to peace to further commercial enterprise. An initial flare of trumpets and the initiation of an ambitious program is begun. Probably an initial huge appropriation is made by Congress and large orders are given to the manufacturers.

A huge corps of flyers is involved, with the attendant cement construction, blue grass fields, and flyers crashing around aerodromes. Some lines are opened up commercially by miltary flyers, some privately, and much publicity attends the event. The next call for money finds a reluctant Congress, and a restriction of funds against further demands. The government program has resulted in no competitive buying and many manufacturers are beginning to be frozen out. The commercial operator, receiving no direct subsidy and much of the money having gone to pay for cement and grass, is getting little or no help. He cannot compete with the government, nor can he compete with the foreigner getting direct subsidy; losing money, he quits. Such is the logical development of mixing commercial enterprises with government civil or military departments. This is now occurring in England.

I consider that the only reason that legislation, putting commercial regulation of flying and commercial development in the proper commercial department in the United States is not in existence and functioning, is that the partisans of a United Air Service, by publicity and propoganda, have obscured the issue and thus have prevented and obstructed the pasasge of such legislation. A bill for this purpose is now before Congress, and strong recommendation and support for its passage from members of the Army, Navy and Post Office Departments, and from civilian aviation organizations, manufacturing, using, or interested in flying, would have insured its passage before this. Had support been forthcoming, appropriations would have been made in 1919, 1920, 1921, and in the current appropriation bills, to boost commercial flying and map out and construct the airways that are so urgently needed.

Aviation is suffering from a plethora of misdirected and hysterical chatter that will ruin its commercial future if listened to. Meanwhile, this chatter has prevented the accomplishment of the very things the chattering covers. Fortunately, the new administration, with characteristic keenness, has analyzed the situation and seen this, and has recommended the passage of the proper legislation.

When the aircraft manufacturers protest against the existence of the three separate buying agencies now in the Army, Navy and Post Office Departments, which are keeping him alive, he forgets that an amalgamation of them would restrict buying, and probably induce more government construction, and in the end many firms, who now owe their existence to the fact that these agencies are in being, would be compelled to quit business.

If forty government buyers were in the market for aircraft instead of three, so much the better from the manufacturing standpoint. The fable of killing the goose

that laid the golden egg has its most modern example in the spectacle of a manufacturing industry shouting to have discontinued the existence of its patronage.

That the manufacturer and operator is impatient with development is true, but the underlying cause is a defect inherent in aviation. Its progress will astound its most ardent advocate when its commercial practicability is realized, and appropriations will be forthcoming. When this condition occurs, if the commercial operator and manufacturer finds his neck in the noose of a government military department controlling and retarding manufacturing, operations and progress, there is going to be a repetition of the wails from business men that greeted government ownership of railroads and of the merchant marine.

Aviation can never expect direct subsidy from Congress. The House and the people have always fought direct assistance to business. Indirect subsidy is the answer. A bureau in the Department of Commerce to secure appropriations and develop commercial aviation; and, engaging in as many other activities giving indirect subsidy as possible, is the solution—Lighthouse service for lights, Army and Navy for military orders, Post Office service for its demands, Weather Bureau for aerology, etc. In this way the most help can be received. Lump these activities and the staggering sum of the total appropriation to one department will curtail the amounts, and, at that, most of the money appropriated will be diverted to the military corps involved

In conclusion, I wish again to make the point that the major reason that proper legislation is not in effect and functioning, is the dissension in aviation itself, and the propaganda emanating from the ambitious political opportunists who hope to reap personal profit from a United Air Service.

DAILY WEATHER REPORT FOR AVIATORS BY RADIO

IN cooperation with the Office of Communications of the Navy Department, the U. S. Weather Bureau will issue a special bulletin containing surface weather observations from regular Weather Bureau stations, upper air observations from aerological stations maintained by the Navy, Army, and Weather Bureau, and a summary of weather conditions, forecasts and warnings. The bulletin is for the benefit of marine and aviation interests, but is designed especially to meet the needs of the latter. The bulletin will begin June 1, 1921, and will be broadcast from the Naval radio station at Arlington, Va., each morning at 10:30 o'clock (75th meridian time), Sundays and holidays included. This service is in addition to the distribution now being made each night from the Naval radio stations at Arlington, Va., Key West, Fla., Point Isabel, Tex., Great Lakes, Ill., and San Juan, P. R., as described in Weather Bureau circular of October 26, 1920.

Explanation of Bulletin

The bulletin is divided into two parts and invariably begins with the letters USWB (U. S. Weather Bureau). The first part consists of surface weather conditions based upon observations taken at 8 a. m., 75th meridian time, and of upper air observations begun at 7 a. m., 75th meridian time, or the date of distribution. The second part of the bulletin consists of synopsis of general atmospheric pressure distribution, including the locations of high and of low areas, and the barometer readings at their centers; wind and weather forecasts for Atlantic and east Gulf offshore areas; storm and hurricane warnings for these areas; and flying weather forecasts for each of six aviation zones (chart on page 4).

The bulletin will be broadcast from ARLINGTON, VA., at 10:30 a. m., 75th meridian time, each day (Sundays and holidays included). Wave length, 5,950 meters, CW.

FIRST PART

Key-letters and stations

J	St. Johns, N. F.	AT	Atlanta, Ga.
S	Sydney, N. S.	TA	Tampa, Fla.
CK	Cochrane, Ont.	P	*Pensacola, Fla. (Upper air Pensacola)
FP	Father Point, Que.	MG	Montgomery, Ala.
ML	Montreal, Que.	VK	Vicksburg, Miss.
E	Eastport, Me.	NO	New Orleans, La.
N	Northfield, Vt.	LR	Little Rock, Ark.
T	Nantucket, Mass.	GV	Galveston, Tex.
NY	*New York, N. Y. (Upper air Rockaway)	NV	Nashville, Tenn.
AC	*Atlantic City, N. J. (Upper air Lakehurst)	CN	Cincinnati, Ohio
WA	*Washington, D.C. (Upper air Washington)	PB	Pittsburgh, Pa.
NF	*Norfolk, Va. (Upper air Hampton Roads)	F	Buffalo, N.Y.
LB	Lynchburg, Va.	D	Detroit, Mich.
AV	Asheville, N.C.	L	Alpena, Mich.
H	Hatteras, N.C.	M	Marquette, Mich.
C	*Charleston, S.C. (Upper air Parris Island)	CH	Chicago, Ill.
B	Bermuda	DU	Duluth, Minn.
CO	*Columbia, S.C. (Upper air Due West)	LC	La Crosse, Wis.
JA	Jacksonville, Fla.	SL	St. Louis, Mo.
K	*Key West, Fla. (Upper air Key West)	KC	Kansas City, Mo.
		O	*Omaha, Nebr. (Upper air Fort Omaha)
		OK	Oklahoma City, Okla.
		DA	Dallas, Tex.
		EP	El Paso, Tex.

* *Note*—Stations with which upper air observations are included.

The stations are indicated by one or more key-letters which are followed by two or more 5-unit groups of figures. The first two groups are always surface observations taken at the stations indicated by the key-letters. Additional groups containing upper air data are included only in the reports from stations marked with an asterisk (*), and invariably are represented in the third and succeeding 5-unit groups.

When upper air observations are not possible because of dense fog, the word FOGGY will be sent instead of the third group.

The names of the aerological stations are not included in the bulletin. Observations therefrom are made a part of the report of the nearest regular Weather Bureau station. The location of the aerological stations, the service that conducts them, and the surface stations with which the data are coded are as follows:

Aerological stations	Conducted by	Surface stations with which upper air reports are included
Rockaway, N. Y.	U. S. Navy	New York, N. Y.
Lakehurst, N. J.	U. S. Navy	Atlantic City, N. J.
Washington, D. C.	U. S. Weather Bureau.	Washington, D. C.
Hampton Roads, Va	U. S. Navy	Norfolk, Va.
Parris Island, S. C	U. S. Navy	Charleston, S. C.
Due West, S. C.	U. S. Weather Bureau.	Columbia, S. C.
Pensacola, Fla.	U. S. Navy	Pensacola, Fla.
Key West, Fla	U. S. Weather Bureau.	Key West, Fla.
Omaha, Nebr	Signal Corps, U.S.A.	Fort Omaha, Nebr.

When data for a portion of a group are missing the letter X will be substituted for each missing figure.

SECOND PART

The second part of the bulletin is in plain language and consists of: a synopsis of general pressure distribution; wind and weather forecasts for ocean zones for a period of 24 hours beginning at noon day of issue (see chart page 4); storm and hurricane warnings; and flying weather forecasts by zones for a period noon to midnight of day of issue (see chart page 4.)

Explanation of Groups

FIRST GROUP (surface).—*Barometric pressure* reduced to sea-level and expressed in three figures; *wind direction* expressed in one figure; and *wind force* (Beaufort scale (expressed in one figure.

SECOND GROUP (surface).—*State of weather* expressed in one figure; *barometric tendency* (rise or fall in hundredths of an inch during two hours immediately preceding the observation) expressed in one figure; and *clouds* expressed in three figures, indicating, in order, the amount of the clouds the lower elevation; the fourth and fifth figures represent, re-(tenths of sky that is covered), the kind of clouds, and the direction of cloud movement.

THIRD GROUP (upper air).—Two levels are included in this group, 250 meters and 500 meters. The first figure identifies the group; the second figure indicates the wind direction at the lower elevation and the third figure the wind force at the lower elevation, the fourth and fifth figures represent, respectively, the wind direction and force at the higher elevation.

FOURTH GROUP (upper air).—Includes 1,000 and 1,500 meter elevations; same arrangement of the five significant figures as in the third group.

FIFTH GROUP (upper air).—Includes 2,000 and 3,000 meter elevations; same arrangement of the five significant figures as in the third group.

SIXTH GROUP (upper air).—Includes 4,000 and 5,000 meter elevations; same arrangement of the five significant figures as in the third group.

LAST GROUP (upper air).—Shows the highest elevation

reached. The first figure (7) identifies the group as the one showing the maximum altitude, and it may be the fourth, fifth, sixth, or seventh group, dependent upon the actual elevation reached; the second and third figures indicate the elevation in hundreds of meters; the fourth and fifth figures are wind direction and velocity, respectively, at the indicated elevation.

Key of Groups and Examples

FIRST GROUP: *Barometric pressure* (first three figures of group): Actual pressure in inches and hundredths used, except that first figure of full reading is omitted. Thus, if the actual corrected pressure is 29.98 inches, the figures 998 are sent, or if the reading is 30.14 inches, the figures 014 are sent.

Direction of surface wind (fourth figure of group).

0=calm or no movement.
1=north. 5=south.
2=northeast. 6=southwest.
3=east. 7=west.
4=southeast. 8=northwest.

Force of wind (fifth figure of group): Sent according to Beaufort scale values 0 to 9, inclusive.

Beaufort Scale

Scale number	Designation	Miles Statute	Miles Nautical
0	Calm	0–3	0–3
1	Light air	3–8	3–7
2	Light breeze	8–13	7–11
3	Gentle breeze	13–18	11–16
4	Moderate breeze	18–23	16–20
5	Fresh breeze	23–28	20–24
6	Strong breeze	28–34	24–30
7	Moderate gale	34–40	30–35
8	Fresh gale	40–48	35–42
9	Strong gale	48–56	42–49
*Ten	Whole gale	56–65	49–56
*Eleven	Storm	65–75	56–65
*Twelve	Hurricane	75	65

* *Note*—The code does not admit of force in excess of 9 being sent. Therefore, the figure 9 will be used for all wind forces 9 to twelve inclusive.

Example of first group as sent: 99852.

Translation: Barometric pressure, 29.98 inches, wind from south, wind force, 2 (8 to 13 statute miles per hour).

SECOND GROUP: *Present weather* (first figure of group): State of weather at surface at 8 a. m., 75th meridian time.

1=clear (3 tenths or less). 5=snowing.
2=partly cloudy (4 to 7 tenths). 6=thunderstorm.
3=cloudy (8 to 10 tenths). 7=sleeting or hailing.
4=raining. 8=dense fog.

Pressure change (second figure of group) in hundredths of inch during two hours preceding observation.

0=change of less than .04 inch.
1=increase of .04
2=decrease of .04.
3=increase of .06.
4=decrease of .06.
5=increase of .08.
6=decrease of .08.
7=increase of .10.
8=decrease of .10.
‡9=increase or decrease of .12 or more.

Amount of clouds (third figure of group): Number of tenths of the sky obscured (10 tenths is total cloudiness).

‡NOTE—Whether it is an increase or decrease can be determined by barometric tendency shown at surrounding stations.

0=1 tenth or less of sky covered.
2=2 to 3 tenths of sky covered.
4=4 to 5 tenths of sky covered.
6=6 to 7 tenths of sky covered.
8=8 to 10 tenths of sky covered.

Kinds of clouds (fourth figure of group).

0=1 tenth clouds or less (kind not indicated).
1=upper clouds (cirrus, cirro-stratus, cirro-cumulus, alto-cumulus, or alto-stratus), rapidity not indicated.
2=strato-cumulus moving slowly.
3=strato-cumulus moving rapidly.
4=cumulus moving slowly.
5=cumulus moving rapidly.
6=stratus moving slowly.
7=stratus moving rapidly.
8=nimbus or cumulo-nimbus moving slowly.
9=nimbus or cumulo-nimbus moving rapidly.

Direction of cloud movement (fifth figure of group).

0=no movement observable.
1=north. 5=south.
2=northeast. 6=southwest.
3=east. 7=west.
4=southeast. 8=northwest.

When both upper and lower clouds are observed, only the amount, kind, and direction of the lower clouds will be sent. In such cases the amount of the upper clouds, if any, can be determined approximately by taking the difference between the tenths of cloudiness interpreted from the figures showing "present weather" and "amount of clouds."

Example of second group as sent: 30855.

Translation: Cloudy weather; pressure change less than .04 inch during preceding two hours; 8 to 10 tenths clouds; cumulus clouds moving rapidly from the south.

The upper air observations are included in five groups and have identifying numbers 3 to 7, inclusive. The wind direction and force are indicated by the same numerals as for surface wind direction and force.

THIRD GROUP. (Five figures) 250 and 500 meter levels. The identifying figure for this group is 3, and is always the first figure of the group. The second figure is direction of wind at 250 meters and the third figure is wind force at 250 meters. The fourth figure is wind direction at 500 meters and the fifth figure is wind force at 500 meters.

Example: 35163.

Translation: Observations at 250 and 500 meter levels; wind blowing from south with force 1 (3 to 8 statute miles per hour) at 250 meters; wind blowing from southwest with force 3 (13 to 18 statute miles per hour) at 500 meters.

FOURTH GROUP (1,000 and 1,500 meters), FIFTH (2,000 and 3,000 meters), and SIXTH (4,000 and 5,000 meters) have the same arrangement as group three, the first figure, 4, 5 and 6, respectively, always identifying the groups.

LAST GROUP (highest elevation reached). The first figure (7) identifies the group; the second and third figures indicate the elevation in multiples of 100 meters; the fourth and fifth figures show wind direction and force, respectively, at that elevation.

Examples: (*a*) 71785, (*b*) 71954, (*c*) 75879.

Translation:

(*a*) Highest elevation reached, 1,700 meters; wind blowing from northwest with force 5 (23 to 28 statute miles).

(*b*) Highest elevation reached, 1,900 meters; wind blowing from south with force 4 (18 to 23 statute miles).

(*c*) Highest elevation reached, 5,800 meters; wind blowing from west with force 9 (48 to 56 statute miles).

GROUND-PLANE INFLUENCE ON AEROPLANE WINGS

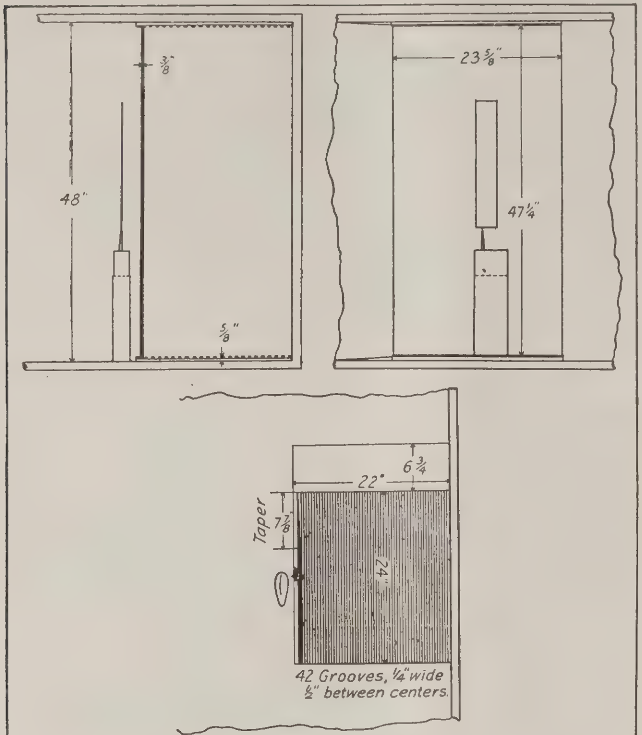
By A. F. ZAHM, Ph.D., and R. M. BEAR, B.S.*

Bureau of Construction and Repair, U. S. N.

Preface.—As the air action on the wings of an aeroplane may change materially, for a given speed and poise, when the craft leaves or approaches the earth's surface, the nature of this change has been deemed worth investigating with a model in the wind tunnel. A test made on a single British R.A.F. 6 aerofoil at 40 miles an hour in the 4' x 4' tunnel, at the Washington Navy Yard, is described in this article. The model was made of brass and measured 3 x 18 inches; it had the form of profile shown in Fig. 5.

Method of Measurement.—Fig. 1 shows the apparatus for the test assembled in the 4' x 4' tunnel. The aerofoil is held as usual at the extremity of the tapering spindle of the cross-arm wind balance, and has at one side a "ground-plane" parallel to the walls of the tunnel and held at its top and bottom edges in two grooved planks as shown. The plane, made of ⅜" laminated pine, is about two feet wide along stream and chamfered to a thin edge on the side remote from the aerofoil. The guide boards are grooved for a distance of two feet, then chamfered upstream to edges flush with the floor and the ceiling. The grooves are ¼" wide and spaced ½" be-

* Courtesy *Franklin Journal.*



Aerofoil and ground-plane in 4 x 4 foot tunnel.

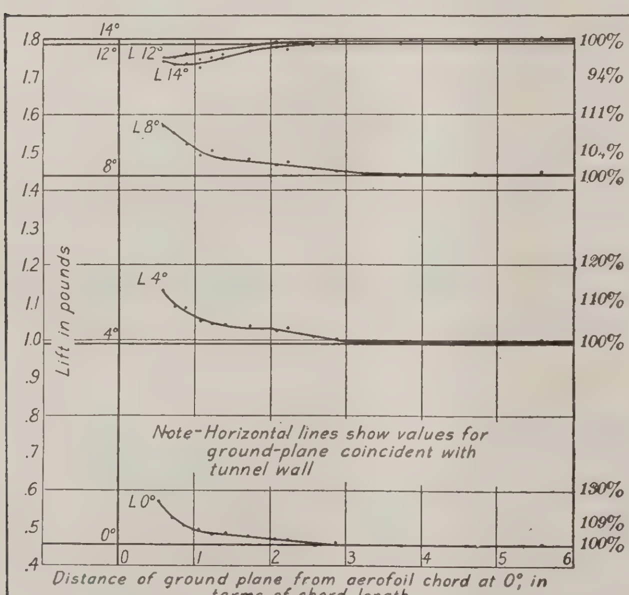
Fig. 1.

tween centers; and each indicates the distance from the nearest face of the plane to the chord of the aerofoil at zero pitch.

For each setting of the ground-plane, the lift, drag, and pitching moment was measured in the usual way at 40 miles an hour and 0°, 4°, 8°, 12° and 14° pitch. In successive settings the ground-plane was moved laterally, by increasing steps, up to 16½", then removed from the tunnel or set over against its wall; this farthest displacement being about the equivalent of removing the plane entirely, when allowance was made for the change of cross-section of the tunnel due to such removal.

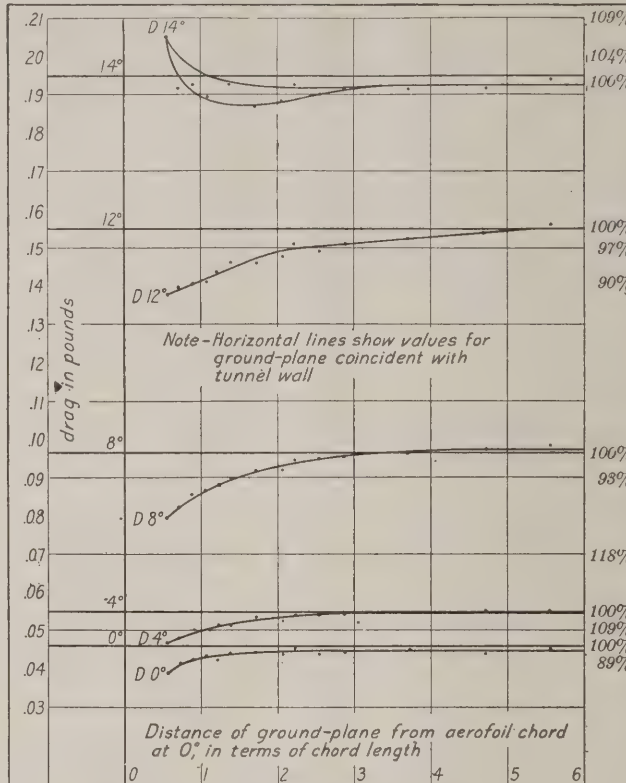
Values of Lift and Drag.—The measurements of lift and drag are not tabulated but are plotted to ample scale in Figs. 2, 3, 4.

For all angles of incidence, as should be expected, the graphs of lift, drag, and lift-drag curve less and less rapidly as the ground-plane shifts from about half a chord length successively to greater distances from the aerofoil. They each tend to approach asymptotically a horizontal line which marks, for the represented quantity, the value obtained with the ground-plane indefinitely distant.



Lift *versus* ground-plane distance "*below*" aerofoil. Air speed 40.3 m. p. h.

Fig. 2.

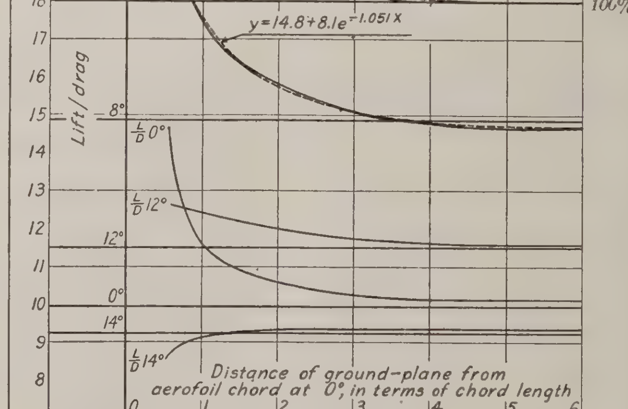


Drag *versus* ground-plane distance "*below*" aerofoil. Air speed 40.3 m. p. h.

Fig. 3.

The curves are roughly exponential and may be expressed in the form $y=a+b\,e^{-cx}$, where a is the asymptotic value, $a+b$ the initial value, x the ground-plane distance, c the coefficient of decay of the ground-plane influence. The dotted lines in Fig. 4 are true exponential curves and coincide with the actual plotted data to within the degree of precision of the measurements. The numerical equations were derived from straight-line graphs of the data plotted on semi-logarithmic paper.

As the pitch increases from its smallest value 0°, up to near the burble incidence, the lift falls, and the drag rises with enlarging gap between the aerofoil and the ground-plane; also for these conditions the curves are farther separated from their asymptotes initially, and reach practical contact with



$\frac{\text{Lift}}{\text{Drag}}$ *versus* ground-plane distance "*below*" aerofoil. Air speed 40.3 m. p. h.

Fig. 4.

them farther from the origin. The asymptotes in all cases were hurriedly found from a single measurement, and in some instances seem to be less trustworthy than the curves approaching them.

As the pitch approaches the burble angle the ground-plane effect diminishes roughly to 0, then becomes increasingly negative as far as the test discloses..

The numbers on the right-hand side of Fig. 4, at the top, indicate that the efficiency of a monoplane wing closely swimming the earth's surface may be increased 20 or 30 per cent. at 4° incidence. A still higher efficiency is indicated by the lift-drag curves for smaller angles of incidence.

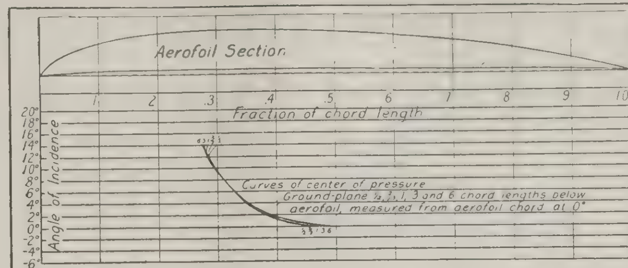
From Figs. 2 and 4 it appears that at small incidences a monoplane is considerably better sustained and more easily propelled near a ground-plane than when two or three chords above it. This fact might be turned to account in navigating above smooth water. It is distinctly marked by the pilot in trying to land at too high a speed on a flat surface. The aeroplane tends to rebound as if striking a denser medium.

A complete set of readings also were taken with the ground-plane "above" the aerofoil, that is, opposite its more chambered surface. The most striking features of these readings are the great increase of lift with increasing incidences up to 12°, and the considerable increase of drag with proximity of the ground-plane at all the incidences used, *i.e.*, from 0° to 14°. The data were taken rather for completeness than for their practical importance, and hence are not given here.

Pitching Moment and Center of Pressure.—From the measured lift, drag and pitching moment at 0°, 4°, 8°, 12° and 14° incidence, the center of pressure was computed with the gap fixed first at one-half the wing chord, then successively at larger fixed distances. The travel of the center of pressure is given in Fig. 5 and shows but slight ground-plane influence.

Concluding Paragraphs

Reference.—On completion of this article the writers' attention was called to an account, in the *Ace* for December, 1920,



Aerofoil section and centre of pressure. Air speed 40.3 m. p. h.

Fig. 5.

of a test by Mr. A. A. Merrill, of the ground influence on a biplane model at the single angle of incidence of 13°. He observed at this angle a slight ground effect and shift of the center of pressure. He concludes: "This experiment then seems to show that the correction for ground effect upon landing is small though not negligible."

Dr. A. Bezt reports[1] for lift and drag only, the ground influence on a curved zinc plate to be quite similar to that found in the present test of a regular wing form. His model measured 10 x 60 millimeters, and was tested in a tunnel about two meters square in cross-section.

Summary.—The present study discloses a very material ground-plane influence at small incidence and ground gap. The lift is augmented, the drag diminished; the lift-drag may be increased 30 to 40 per cent. Thus a sea gull or a suitably designed monoplane may skim the surface of smooth water with considerably greater economy than it can fly at a few wing depths aloft. But the pitching moment is only slightly affected by the presence of a ground plane.

[1] Zeitschrift für Flugtechnik und Motorluftschiffahrt, 1912.

CLOUD-FLYING INSTRUMENT BOARD

THE following article describes the experience of Lt. John P. Van Zandt of the A. S. Engineering Division, Dayton, Ohio, in a recent flight from Dayton to Washington in which the value of certain cloud-flying instruments was demonstrated:

One of the problems of the Navigation Branch of the Engineering Division is to make possible regular scheduled flights regardless of weather conditions. On the aerial highway between Washington and Dayton, Ohio, unfavorable conditions are often met with over the Alleghenies. Recently, the weather has been so consistently unfavorable that two of the Martin Bombers from Dayton on their way to Langley Field have been held at Moundsville, W. Va., for several days waiting for good flying weather.

A DH-4B from the Navigation Branch, however, was able to complete the flight from Dayton to Washington recently on schedule time regardless of fog and storm, primarily because it was equipped with an experimental cloud - flying instrument board. The instrument board in question does not comprise any new or novel idea but is simply a very compact arrangement of turn indicator, lateral and fore and aft inclinometers and compass mounted directly before the pilot on a special board in the position where the compass is usually mounted. The turn indicator is wind-driven by means of a Venturi tube fastened to one of the center section struts. The particular board in question was primarily designed to enable the plane to be flown straight and level during sextant observations.

On the particular flight when this instrument board proved invaluable the plane left Moundsville in company with the two Martin bombers about 2:30 P. M. and headed southeast in the direction of Washington. After flying about 15 minutes at a ceiling approximately 1000 feet, the formation ran into wisps of fog and, although the planes were flying fairly close together, they disappeared from each other's sight completely for the moment. The sky ahead was very forbidding and it was obvious that it would be necessary to go up through the storm in order to get across the Alleghenies or else turn back.

At this point the D. H. parted company from the Martin bombers and entered the fog, losing complete sight of the ground and every fixed landmark. The air was very rough and in a few minutes, the plane had swung completely off the course and was found to be pointed almost west when righted again. It was obvious that complete reliance would have to be placed on the cloud-flying instrument board if the plane was to be kept on an even keel or if any pretense was to be made toward following a given course. After some disagreeable minutes getting on to the knack of flying with one's head in the cockpit, the plane was set on its course and headed 20° southeast and at a steady drive with nothing to be seen but the great white fog which completely enveloped the plane. Before climbing very long, the drift wires became loaded with sleet and snow, the air speed meter froze up and indicated 35 miles an hour and the plane became so heavy that it was impossible to climb above 10,000 feet. The plane was actually sinking through the air and still there was no indication that the top of the fog had been reached.

It was decided to motor down slowly, for by this time the Alleghenies must have been crossed. After an hour and a half in the fog, the machine at last emerged, fortunately right on the course and a few miles west of the Blue Ridge Mountains which were crossed at an altitude of 500 feet and, picking up the Potomac, followed it into Washington, landing shortly after 5 P. M.

This was the only plane which successfully completed the flight of the four which started out that afternoon. It is safe to say that the trip would have been impossible without the use of a cloud-flying instrument board or at least the instruments which go to make up such a board. There is no question that it is impossible to maintain equilibrium long in a dense, bumpy fog without the use of instruments, whereas an attempt to follow a given course is entirely out of the question under such circumstances. It is, however, equally clear that with the proper installation of a turn indicator, bubble inclinometers and adjusted compass, any desired course can be maintained for indefinite length of time in any kind of weather.

The standardization of a compact group of cloud-flying instruments should prove invaluable under general service conditions. It is undoubtedly true that many of the accidents and fatalities which have occurred in aviation have been due to this very same difficulty of flying in an even keel in thick fog. It is not at all unlikely that the recent accident at Langley Field was due to this very thing. Unfortunately, most of the accidents which occur from pilots becoming confused in a fog result in fatalities so that the victims of the situation are not able to testify to the need they had for cloud-flying instruments. It is hoped before long that the Engineering Division will be able to specify a standard group of cloud-flying instruments, and that all pilots who ever have occasion to fly in thick weather will have available means to prevent such cloud-flying accidents as have occurred in the past.

FOREIGN TECHNICAL DIGEST

Intelligence Tests at High Altitudes

In order to study mental efficiency at great heights Dr. Koschel employs a pneumatic chamber which can be made to agree with a rarefaction up to 7,500 metres in height. The results of the tests carried out on various persons are very interesting, and it is noted that up to 5,500 metres, apart from a certain fatigue and lassitude, no more serious trouble was observed. At 7,000 metres the mental efficiency of all the subjects was in every respect considerably impaired. Photographs of the apparatus employed in this research are given.

[*Aeronautics,* March 31, 1921]

The 600 H.P. Farman Engine

A photograph and description of a new type water-cooled engine. It is an 18-cylinder model, the cylinders being in three rows of six each, and having a bore of 120 mm. and a stroke of 180 mm. Normal revs. 1,800 per minute. A reduction gear is fitted at the propeller end of the shaft.

[*Aeronautics,* March 24, 1921]

Amphibians

A report of a lecture before the Wissenschaftliche Gesellschaft für Luftfahrt, dealing with the machine which took part in the British amphibian competiton, 1920. Full descriptions of the various machines are given, with scale drawings and detail sketches. The weights and performances are analyzed, and the lecturer proceeds to discuss the factors affecting length of take-off and landing run. In order to compare what has been achieved in amphibian design with what might be done, he discusses an hypothetictl all-metal machine, with variable camber, cantilever wings and other innovations, such as a useful load of 40 per cent. of the total weight and a top speed of 125 m.p.h. with a power loading of 14.7 lbs. h.p. His closing remarks may be worth quoting in extenso:

"Now, what have the English constructors accomplished? Their aeroplanes are very dear. The petrol consumption is very high. The life of the machines is remarkably short; the proportion of useful load to total weight quite small. The comfort of passengers is entirely non-existent. That may be all right in the colonies, where the passengers are more or less hardened; but there one will require ability to resist the weather and great reliability. These are the least conspicuous qualities. Not one of the machines could reach the required low speed. We can safely conclude that the eGrman industry, despite its heavier engines, will succeed in producing something better." ["*Zeitschrift für Flugtechnik u. Motorluftschiffahrt,*" March 31, 1921.]

Synthetic Alcohol

The production of alcohol from calcium carbide having been stated in a French newspaper to cost 5 centimes per litre, the article under review was written to disprove the statement.

Synthetic alcohol can be, and has been, made on a commercial scale, by transforming acetylene into ethyl-aldehyde and adding hydrogen. This process was used in Germany and Switzerland during the war, the alcohol being required chiefly to enable these countries to operate the large number of internal combustion engines previously run on petrol. To produce 1 kg. of alcohol, however, 1.6 kg. of carbide and .45 kg. of hydrogen are theoretically necessary, but in practice these quantities should be increased some 20 per cent. The cost of the raw materials is therefore approximately 2½ francs per litre of alcohol, and it is significant that the various Swiss works which were engaged on the production of the spirit during hostilities have now ceased to manufacture it. It is possible that in the event of the price of calcium carbide being sufficiently reduced, synthetic alcohol will again be produced in commercial quantities. (*Journal de l'Acetylene,* Nov., 1920. 2 cols.)

German All-Metal Commercial Machines

"The most conspicuous features of German aeroplane construction are the use of wholly or mainly strutless wings and a decided preference given to the monoplane. In fact, all German machines designed for commercial purposes since the end of 1919 are monoplanes. The reduction of air resistance thus obtained allows the engine capacity to be held down, thus affording a good basis for a safe and economical service. The most important factor relied upon in this progressive policy is the exclusive use of metal as material of construction.

"The Zeppelin Works at Lindau are, it seems, the oldest Continental firm exclusively engaged in all-metal aeroplane construction. Thanks to the liberal financial support received from the late Count Zeppelin, the manager of these works, Chief-Engineer Dornier, was in a position for more than six years to conduct the establishment on a merely experimental basis and, unhampered by any immediate commercial consideration, quietly to work out and elucidate the fundamental problems of all-metal aeroplane construction, discarding any pipe structures and welds. Highgrade steel and duralumin were from the very outset considered the only possible materials of construction, the latter affording special difficulties mainly due to the absence of any suitable heat treatment. Whereas any parts put to high strain, such as cross frames, engine beds, shafts and the like, were made of hardened steel exclusively, duralumin was mainly resorted to in the manufacture of fuselage, boats, floats, spars, etc. The designing of especially favorable cross-section profiles of steel and duralumin for many years constituted one of the main tasks of the works, the data required for calculation being provided by extensive load tests on cross frames, spars, and shafts, as well as whole wings and machines. This work was assisted by aeroplane testing in the air. Special designs created during the last few years comprise the 4-engine R-monoplanes, flying-boats, and two-engine aeroplanes."

The article describes and illustrates the various types of all-metal Dornier machines. (*Aeronautics,* May 5. 3 pages. 4 illustrations.)

The Van Berkel Seaplane

The Berkel monoplane is a twin-float seaplane, with a 4-blade tractor screw, which is driven by a Rolls-Royce engine. The latter is of the commercial type Eagle VIII, with low-compression pistons; it gives 330 to 350 h.p., and is fitted with the latest type cylinders and epicyclic gear. This seaplane has no tail or wing floats. The fuselage is swept up towards the rear, the tail unit being high above the water. The wings are fitted to the bottom longitudinals of the fuselage. The wing construction is of the semi-cantilever type, the wings being braced to the floats only. The upper side of the planes is clear of any bracing whatever. The floats are interconnected by two heavy stream-line tubes, and by diagonal cross-bracing.

There are two tubes running from each float to a point just beyond the middle of the wing-spars. These lift tubes being rather long, there are short bracing struts fitted, which connect the center of the lift tubes with the spar at a point half-way between the fuselage and the above-mentioned point, where the lift tubes are attached to the spars. There are diagonal bracing wires between the front and rear lift tubes as well as between the floats, and horizontal struts interconnect the center points of these tubes.

Between the fuselage and the floats is a very strong framework of steel tubes, partly stream-lined with wooden fairings. Seen from the propeller end of the machine there are two M-shaped structures, one behind the other. Seen from the side there is an N-shaped structure, together with an extra strut running from the front floatfoot (described below) to the first bulkhead of the fuselage. The outer legs of the two M's are extraordinarily strong tubes: they end in conical feet fitted to the floats with four bolts each. To obtain great seaworthiness the floats are placed a considerable distance apart. The undercarriage is rather on the heavy side, but the constructors claim that it will keep the machine intact even when one of the main tubes has been shot away or is broken.

The floats themselves are constructed of duralumin throughout. They are of the three-step, flat-bottom variety, with air channels behind the steps. These floats are light, strong, and durable, and not affected by sea water. They have seven watertight compartments, each with an inspection door of convenient size, and easily opened by hand, and a drain-plug on the underneath side.

The tail unit consists of stabilizer surfaces on either side of the body, a large rudder, and the elevator. There is no fin. The fuselage ends in a vertical knife edge. Both rudder and elevator are balanced as well as the ailerons. In the case of the latter, this is effected by small planes held in front of, and above, the hinges by two steel tubes, secured to the reinforced ribs of the flap. The tailplane is 3-ply covered, but the elevator and rudder are covered with fabric. The fixed part of the tailplane is stayed on the underneath side by two steel tubes of streamline section; these struts form the only bracing of the tail unit. The main longitudinals of the tailplane are steel tubes, bolted to the fuselage tubes with several conical bolts, which eliminate play entirely. The tailplane is adjustable, but only when not in flight. During normal flight the angle of the tailplane is *zero.* (*Aeronautics,* May 12, 1921. Two pages. 1 illustration.)

NAVAL and MILITARY AERONAUTICS

Bombing the Radio-Controlled Iowa

Secretary Denby authorizes the following:

Among the bombing tests to be conducted jointly by the Army and Navy air forces the latter part of June and the first part of July, the most spectacular and interesting from the public viewpoint will be the search problem and accuracy of bombing test on the radio controlled *Iowa*, scheduled for June 28.

In one respect war conditions will be accurately simulated in this problem, for the old *Iowa*, under the control of a distant ship, will maneuver as an enemy ship, just as though she had a crew aboard, except that her speed will be somewhat reduced. Starting at a point somewhere between fifty and one hundred miles at sea off the Virginia Capes, the *Iowa* will steam toward shore, while the planes from shore, starting at the same hour, will fly out to locate her. When this is accomplished, the bombing with dummy bombs will begin.

For this operation the Army will use only the seven seaplanes it obtained from the Navy and four airships, all of its land planes having been withdrawn from this test. The Navy will have four of the NC type of flying boats and 12 F-5-Ls in the search problem and four Martin bombers, land planes, aiding in the accuracy of bombing tests. The Navy dirigible probably will take part in the search problem.

In order to use the *Iowa* for a moving target, she has been fitted out with special apparatus that will enable her to be controlled by wireless from a ship at a distance. Some extensive changes in the *Iowa's* power plant were necessary, as the propelling machinery must be capable of running for a considerable time without attention. The boilers were changed to burn fuel oil instead of coal and automatic devices for feeding the fuel to the burners and supplying water to the boiler were provided.

The apparatus for controlling the ship consists of a standard radio transmitter aboard the controlling ship, a receiving aerial on the *Iowa* with special radio receivers, amplifiers, relays, etc., for converting the radio signals into a form such that they will operate the electrical devices which control the steering gear and the throttle of the main engines.

The officers in charge of sending out the radio signals from the control ship has absolute control of the starting of the *Iowa*, steering her in any direction and stopping her when desired. The various operations which take place are as follows:

When everything on board the *Iowa* is ready, the main engines are started up and are left running very slowly. The ship is then abandoned and the officer aboard the controlling ship has control of the *Iowa*. The first radio signal sent out is intercepted by the aerial on the *Iowa* and is received by the radio receiver located well below deck.

This signal is then amplified by means of special vacuum tube amplifiers and is made to operate a very sensitive relay or switch, which in turn operates a larger relay. This large relay closes an electrical circuit which operates an electrically controlled pneumatic valve. When this valve opens, it admits compressed air to the throttle control of the main engines, which causes the throttle to open and bring the ship up to full speed.

The above mentioned relay also operates a device called a commutator, which is a special switch having control of the steering mechanism.

The steering gear consists of a standard steam engine driven rudder gear, the throttle valve of the engine being geared to a small electric motor. The commutator is connected to the control panel of this motor and is thus able to operate the electric motor, which in turn causes the steam engine to drive the rudder to either starboard or port as desired.

A very novel feature of this installation is the automatic steering, which is made possible with the aid of a gyro-compass. The compass is electrically connected to the control panel of the electric motor on the steering gear, so that the ship can be made to hold any course, the gyro-compass immediately operates the steering gear to return the ship to her course. The officer sending the control signals can steer the *Iowa* to either starboard or port or may put the gyro-compass in control and hold a steady course.

The commutator might be considered the mechanical brains of the *Iowa*, it receives the radio signals and interprets them, passing them on directly to the electric motor controlling the steering engine, if the order is either starboard or port, or giving the gyro-compass control, if that is the order.

If the officer in control desires to stop the *Iowa*, he sends a long signal of about ten seconds duration. This operates a special relay which opens the circuit on an electrically controlled pneumatic valve, which shuts off the various fuel oil and feed water pumps, thus shutting down the power plant and stopping the ship.

A special safety device is provided in the form of a time clock, which automatically shuts everything down in case the radio receiving apparatus should become inoperative, or in case no control signals were received after a certain lapse of time.

The radio receiving instruments and amplifiers are Navy type instruments. The special relays for converting the radio signal to a form which can be made to control the electrical devices were furnished by John Hays Hammond, Jr. The electrically operated pneumatic valves and their controlling relays for controlling the throttle valves of the main engines, the automatic time clock, the commutator, and the electrical control for the steering gear (with the exception of the gyro-compass itself) were furnished by the General Electric Company.

Dog in Parachute Drop

Rantoul, Ill.—"Bing," a fox terrier, made a descent of 1,500 feet in a parachute from an aeroplane at Chanute Field May 19. When "Bing" landed he worked himself free from his harness, overcame another dog set to prevent his onward journey and ran to headquarters with a message carried in a pouch suspended from his neck.

The performance was to show the practicability of using dogs to carry messages when an aeroplane is unable to land. "Bing" was dropped off of a wing of the ship by Sergt. A. G. Shoemaker.

Changes of Station of Officers for Week Ending May 10, 1921

May 3, 1921.—First Lieut. William C. Farnum, A. S., ordered from Brooks Field, San Antonio, Texas, to Godman Field, Camp Knox, Ky., for duty with 31st Balloon Company.

May 3, 1921.—Capt. Hubert S. Steenberg, M. C., ordered from Carlstrom Field, Arcadia, Fla., to Langley Field for temporary duty during bombing maneuvers, then to Bolling Field for duty.

May 5, 1921.—Capt. Clarence W. Dresser relieved from duty with Air Service at March Field and returned to duty with the Coast Artillery at Fort McArthur, California.

May 5, 1921.—Lieutenant Donald F. Stace, C. A. C., detailed with Air Service, relieved from duty at Fort Monroe, Virginia, ordered to Carlstrom Field, Arcadia, Fla., for pilot training effective August 12, 1921.

May 6, 1921.—Lieut. John D. Barrigar, F. A., detailed to Air Service, relieved from duty at Camp Benning, Ga., and ordered to Carlstrom Field, for pilot training effective July 28, 1921.

May 6, 1921.—Orders previously issued ordering Capt. Ira C. Baker, A. S., to duty at Kelly Field upon his return to the U. S. from foreign service tour at the Philippines, amended so as to order him to Mitchel Field for duty.

May 7, 1921.—Major Lawrence S. Churchill, A. S., ordered from Americus Air Intermediate Depot, Americus, Ga., to Walter Reed General Hospital for observation and treatment.

May 7, 1921.—Capt. Arnold W. Shutter relieved from duty with Air Service at March Field and returned to duty with Field Artillery at Camp Pike, Ark.

May 9, 1921.—Capt. Harold E. Sturcken, A. S., ordered from Air Service Mechanics School, Chanute Field, Rantoul, Illinois, to Carlstrom Field, Arcadia, Florida, for duty.

May 9, 1921.—Lieut. Willard S. Clark, A. S., ordered from Carlstrom Field, Arcadia, Fla., to Kelly Field, San Antonio, Texas, for duty with First Pursuit Group.

May 10, 1921.—Following Air Service officers ordered from March Field, Riverside, Cal., to Carlstrom Field, Arcadia, Fla., for duty as flying instructors: Capt. Charles E. Rust, Lieut. William H. Bleakley, Lieut. Elmer D. Perrin, Lieut. James G. Taylor, Lieut. William W. Welsh.

Changes of Station of Officers for the Week Ending May 17

May 12, 1921—First Lieutenant Clyde V. Bell, relieved from duty with Air Service at March Field, Riverside, California, and returned to duty with the Cavalry.

May 14, 1921—First Lieutenant Carl F. Greene, Air Service, ordered from March Field, Riverside, California, to Letterman General Hospital, San Francisco, California, for observation and treatment.

FOREIGN NEWS

Berlin-Leipzig-Munich-Augsburg Air Service

The Berlin-Leipzig-Munich-Augsburg air service, which was inaugurated for the Leipzig Fair, is to be continued as a regular daily air service by the Rumpler-Luftverkehr, Berlin, and the Bavarian Rumpler Works, Augsburg.

Peking-Shanghai Air Service

Arrangements are being made for the inauguration of an air service between Peking and Shanghai, a distance of nearly 800 miles. With the advice of Group-Captain F. V. Holt, R.A.F., an aviation officer seconded from the British Service, the Aeronautical Department has, the *Times* states, prepared the plans for the Shanghai service to be opened on June 1. The whole distance is 785 miles, divided into three stages—to Tsinanfu, 245 miles; to Nanking, 360 miles; and Shanghai, 180 miles. Besides the points mentioned there will be places of call at Tientsin and Hsuchowfu. It is planned to cover the whole distance, including stops, in nine hours. In addition to regular aerodromes at the stations there will be eight emergency landing-places where petrol and oil can be obtained and pilots can telegraph for assistance. The total capital expenditure on buildings is put at $165,000, and the monthly cost for a daily service at $40,000. Revenue for full loads all the time would be more than double the running expenses, but the department for a commencement will be very satisfied to make the service pay its way. As Chinese pilots are not yet available, a number of capable foreign airmen have been engaged in Europe and America. Earlier flights will be restricted to the transport of mails, and passengers will not be carried until the safety of the service has been amply demonstrated. Naturally the greatest care will be taken to avoid accident, for any smash involving life would prejudice aviation for years to come.

Prague-Warsaw Air Line

The Franco-Roumanian Air Navigation Co. has opened its direct communication, Prague to Warsaw. Aeroplanes leave the Prague Aerodrome twice a week, on Tuesdays and Saturdays, at 8 a. m., reaching Warsaw at 1 p. m. The flight from Warsaw to Prague is timed for the same days, the 'planes leaving Warsaw at 8 a. m., arriving at Prague at 11 a. m. From Prague they go on to Strasbourg (3:30 p. m.) and Paris, arriving at the French capital at 7 in the evening. Letters and parcels are also carried. Letters stamped with ordinary stamps together with the special air-post stamps are accepted at all post offices. Prague is bidding fair to become the aerial centre of Europe. Other services inaugurated by the "Icarus" Co. will carry passengers northwards to Dresden and Berlin. Southward flights will be made to Vienna and subsequently, with the consent of the Jugo-Slav Government, to Belgrade as well as to Milan. The flight to Dresden will last two hours, and the service will be a daily one.—(*Special Press.*)

A Notable Flight

A Farman Goliath, carrying 2,250 kilos (2¼ tons), has covered the circuit Paris, Orleans, Rouen, Saint Inglevert, Metz, Dijon, Paris, three times round, making 4,500 kilometres (2,800 miles) in 34 hours. The test, the *Times* states, was made in trials instituted by the Under-Secretary for Aviation for the encouragement of commercial flying.

The New H. P. Monoplane

The new Handley-Page monoplane, which is at present under construction, has been designed specially for the H. P. slotted wing, and the slot will be capable of being opened and closed at will. Not much can be said regarding the machine at present, but we understand that the engine will probably be a 350 h.p. Rolls-Royce "Eagle" low-compression engine, and the speed is expected to be more than 100 m.p.h. The cabin is designed to seat ten or twelve passengers.

Survey by Air

In two hours and a half, Major McLaurin, head of the British Columbia Air Station, completed an aerial survey of the Fraser Valley that produced photographic results and afforded data that could not have been obtained in many weeks in the Field, says the *Aeroplane and Auto Age* for February. This should be a decided argument in favor of the development of flying for commercial and departmental purposes throughout the land.

Spanish Air Routes for 1921

Ambitious routes are proposed in Spain for air traffic in 1921. Among them are: Madrid to Paris via Soria and Logrono; Madrid to Barcelona; Madrid—Valdepenas—Cardoue—Seville—Tangiers; Madrid to Lisbon via the valley of the Tagus.

Ruler of Morvi Buys Plane

The Thakur Sahib, ruler of Morvi, a small native state in western India is reported to have bought a Handley-Page for his private use. The machine has been painted pink, and makes a bright spot of color in the Indian sky. The internal arrangements, for the comfort of twelve passengers, are very elaborate, and an excellent aerodrome for housing the plane has been built at Morvi.

Aviation in Burma

The Government of Burma in tendering their good offices to the World's Board of Aeronautical Commissioners, Inc., in the advancement of aeronautics write under date of April 9th that aviators entering the contests, referring specially to the first aerial derby around the world, will be welcomed by the government and assisted as far as possible.

Landing fields are being established at Rangoon, Maungdaw, Akyab, Thayetmyo, Prome, Letpadan, and Victoria Point.

The Mt. Everest Expedition

The committee in charge of the proposed ascent of Mt. Everest in considering the offer of the World's Board of Aeronautical Commissioners, Inc., to assist in furnishing aircraft for the expedition, say: "It does not appear possible at present for an aeroplane to rise after landing at a height of fifteen thousand feet on the Tibetan Plateau."

The Great Air Tour

In an interesting despatch to the London *Observer* Major C. C. Turner discusses progress of the great French air tour competition as follows:

In tests of commercial aeroplanes arranged by the French Under-Secretary for Air, a Farman "Goliath" biplane, driven by three Salmson 260-h.p. engines, traveled across country a distance of 2,800 miles in 34 hours (flying time). The course was Paris—Orleans—Rouen—Metz—Dijon—Paris. It had to be flown three times, with halts at a number of specified points, halts elsewhere disqualifying. It is expected that other fine performances will be put in this contest, for the following machines also were entered: a Blériot 4-engined triplane; a Latécoère 3-engined biplane; and a Caudron 3-engined biplane.

The Farman "Goliath" is a development from the two-engined Farman daily flying between Croydon and Paris. It weighs (fully loaded) 5¼ tons; empty, about 3 tons. Its "useful load" in this test was 2¼ tons. The pilot was Mons. N. Gonan. The speed of 82½ miles per hour average for the complete tour is very good, indicating, of course, a much higher air-speed in calm air; in such a tour wind is favorable in one part and adverse in another, but the net result is reduced average ground speed.

The "Goliath" two-engine type achieved fame by a journey from Paris nearly to Dakar in Senegal in August, 1919. It carried eight people. It just failed to reach Dakar owing to the loss of a propeller; and with only one of its engines working it was forced to make a slow descent. Apparently, the designers have decided that the installation of another engine reduces the risk, and that if one engine failed, the machine could still carry on.

This supports the experience in the British Air Ministry Tests last year, when of the two-engined types the only one that proved perfectly manoeuverable with either of its engines idle was a machine of exceptional 450 h.p.; and it would appear that, broadly speaking, for a two-engine a non-stop flight of twenty-four and a half hours, covering a distance of 450 h.p.; and it would appear that, broadly speaking, for a two-engine aeroplane designed to carry heavy loads the engines must not be less than about 400 h.p. each.

The "Goliath" holds the duration record, having in June last year made a non-top flight of twenty-four and a half hours, covering a distance of 1,197 miles.

A comparison of the "Goliath" with certain British machines is interesting:—

	Weight (all on)	*Aggregate Power*
"Goliath"	11,750 lbs.	780 h.p.
Vickers "Vimy"	11,057 lbs.	750 h.p.
Handley-Page W.8	12,500 lbs.	900 h.p.
Handley-Page 0.400	12,000 lbs.	750 h.p.

The last-named is the type employed on the Paris-London service. The other Handley-Page is the type that did so well in the Air Ministry Tests; and it is also more economical to operate.

Swiss Air Regulation

The following Regulations governing Arerial Navigation on and above Swiss waters have been issued by the Swiss Federal Council:—

A. *Flight above the water*

(1) Aircraft flying above water must not approach within 200 metres (220 yards) of steamers and large motor boats carrying passengers. Flight above these watercraft at an altitude of less than 200 metres (660 feet) is likewise prohibited.

(2) Aircraft flying at an altitude of less than 200 metres may not cross the path of such watercraft at a distance of less than 300 metres (330 yards).

As a general rule, aircraft should pass behind watercraft at a distance of at least 200 metres.

(3) Aircraft must not manoeuvre in company with these watercraft or carry out turns above them.

All acrobatic flight above and within a radius of 1 km. (1100 yards) of these watercraft is prohibited.

B. *Navigation on the water*

(1) Hydro-aeroplane may only navigate at night on the lakes and navigable water-ways on condition that they are provided with navigation lights (the same as for motor boats).

(2) Hydro-aeroplanes must, moreover, observe the following rules:—

(*a*) A hydro-aeroplane must keep out of the way of all watercraft, of no matter what category, which it may encounter on its course. If, for any reason, a hydro-aeroplane is incapable of maneuvering, and if it is in danger on account of the proximity of a large watercraft, it must notify the latter by means of the alarm signal (7 short blasts in rapid succession repeated several times on a fog horn).

(*b*) Watercraft may only be passed or crossed on the right side at a minimum distance of 50 metres (55 yards) and at a speed entailing neither danger nor difficulty to the watercraft. Passing on the left side is only permitted if rendered necessary by the proximity of the shore or by some other cause.

(*c*) If the path of a watercraft and that of a hydro-aeroplane cross at right angles or almost at right angles, the hydro-aeroplane shall maneuver so as to pass behind the watercraft.

(*d*) A hydro-aeroplane in distress shall ask for assistance by means of the signal of distress (7 prolonged blasts in rapid succession repeated several times on a fog horn, and at night, in addition, a rapid succession of flashes made with the navigation lights).

C. *Departure and arrival of hydro-aeroplanes*

(1) Departure and arrival may only take place if the space in the direction of departure or arrival is free, and shall in no case take place in the direction of departure and arrival of steamers or large motor boats carrying passengers.

For departure, there must be a sufficient free area of water for the hydro-aeroplane to take off and attain a sufficient altitude and speed to permit it to avoid all obstructions.

During departure or arrival no watercraft shall cross the path or crowd upon the course of a hydro-aeroplane.

(2) At night, departure or arrival of hydro-aeroplanes will only be permitted on certain areas of water marked by lights or closed to navigation by surface vessels.

(3) In case of fog on the water, taking off or alighting on the lakes and navigable water-ways is prohibited. Exception to this rule is made in the case of aircraft compelled to alight in emergency.

(4) The areas of waters to be marked with lights will be designated and the slipways for use of hydro-aeroplanes will be determined by the Cantonal Authorities in conjunction with the local authorities and approved air navigation companies.

In case of disagreement between the parties, the decision of the Railway Department shall be final.

ELEMENTARY AERONAUTICS *and* MODEL NOTES

Propeller Pitch and Its Relation to the Model

RATHER unscientific methods are often used when model builders design propellers for their models. Considerable guesswork can be done away with if model designers understand the work required of the propeller; and, indeed, if the propeller were given as much forethought as the model itself, as it should be, record performances would take the place of ordinary flights in many instances.

An important feature that many appear to overlook is the fact that a propeller delivering the greatest thrust from a given engine (or rubber elastic source of power) is not necessarily the one most suited to the model. Assuming that the thrust is measured while the model (or testing apparatus) is stationary, a satisfactory thrust is no indication of the propeller's efficiency when in flight through the air.

For a more nearly accurate calculation of the propeller design it is necessary to ascertain, from mathematical calculations or by observation, the actual forward speed of the model in horizontal flight. This information is a prime essential if we are to adopt a propeller pitch suitable to that particular speed. There is only one speed of rotation that gives the best possible efficiency from a propeller, and the closer that speed is approached the more efficient will be the performance. There is a clearly established relation between the pitch of the propeller and the actual advance of the model, and it is out problem to coordinate these two to as great an extent as possible.

Before considering the problem as related to a model, it is well to bear in mind that somewhat different problems are encountered when dealing with full-sized aeroplanes. For example, the speed of rotation is dependent upon the type of engine used, for there is an economical speed at which it is desirable to have the engine run (usually 12 to 1500 revolutions per minute) and propeller problems are therefore decided upon that basis. In a rubber-driven model, on the contrary, there is no engine efficiency endangered if high or low revolutions are desired, and this factor permits the design of our model propellers to vary greatly in so far as speed of revolution is concerned.

(To be continued)

The Addems Compressed-Air Model

ONE of the largest compressed-air driven models described to the public in many years has undergone tests by its builder, Mr. Walter J. Addems of Judd, Iowa. Mr. Addems has been actively interested in aeronautics for ten years, during which time he has built several man-carrying gliders and a 50 H.P. sport plane. As a natural consequence, the model bears close resemblance to the lines of a full-sized aeroplane and although its weight is more than seven pounds, the engine has proven quite capable of sustaining it in flight for a distance of 180 feet after starting from the ground.

SPECIFICATIONS

Span (upper)	8′-3″
Span (lower)	6′-8″
Chord (upper & lower)	13½″
Angle of Incidence	4 degrees
Gap	13″
Stagger	4″
Wing Section	U. S. A. No. 4
Length Overall	5′-1″
Wing Area	15½ sq. ft.
Total Weight	7 lbs. 3 oz,
Weight per sq. ft.	7.4 oz.

This model is of the single bay tractor biplane type in which the parasite resistance has been kept as low as possible. The average R. O. G. flights obtained with this model have been about 180 feet. In order that the plane may take off as quickly as possible and not use too much of the air supply, a two wheel truck affair is used to carry the tail skid; as soon as the model gathers speed, the tail is lifted and the truck is left behind. This method has been found to increase the length of the flight considerably.

The air container, which is made of light-weight tin, has dome ends and is wound at short intervals with steel wire. They prevent the ends from blowing out. The container is 4 inches in diameter and 20 inches long.

Up to the present time this tank has carried 100 pounds pressure though it is believed that this can be increased without danger of bursting.

The engine is of the three-cylinder rotary type with a bore and stroke of ¾″. The crank case was made from a piece of brass tubing 2″ diameter and 1¼″ from front to back. Ends of the crank case are made of 20 gauge sheet brass. A 9-32″ hole was drilled through the front of the crank case and a piece of brass tubing of that size was inserted and soldered for the propeller shaft. This makes it possible to get oil into the crank case and also forms an outlet for the air which may leak past the pistons.

Rear end of the crank case carries a 1¼″ length of ¼″ (inside diameter) brass tubing. This is the main bearing of the engine and functions as a part of the valve mechanism. There are three 3-16″ holes in this tube, each being in line with a cylinder. These holes are connected with the cylinder heads by means of brass tubing 3-16″ inside diameter. The hollow crank shaft which runs in this tube has a 3-16″ hole in the wall so arranged in relation to the crank that it lines up with each of the three holes as the piston in that respective cylinder is at the top of its stroke.

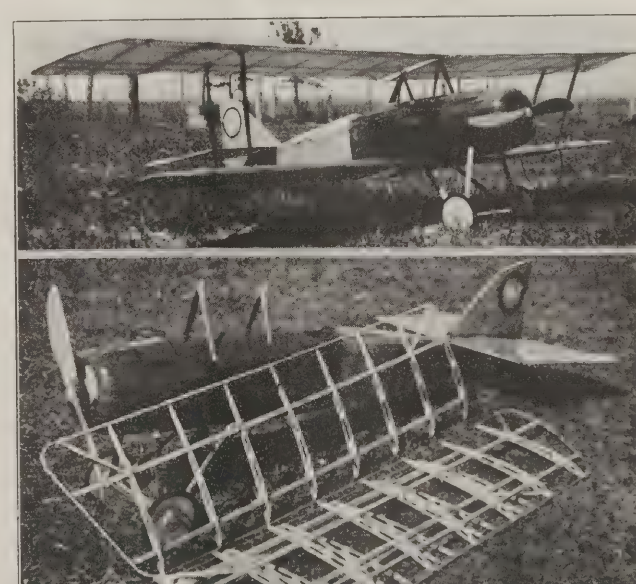
The cylinders have two 1-16″ holes drilled though the walls in such a position that the piston uncovers them at the bottom of the stroke.

This engine turns a 22½″ propeller about 1400 r.p.m., giving plenty of thrust for flying the model shown in the accompanying photograph.

An idea of the wing construction can be obtained from the photograph. The ribs are cut from white pine, are 3/32″ thick, lightened between spars. The wing beams are spruce, the front ones being ¼ x ½″ and the rear ones ¼ x ⅜″. The entering and trailing edges and also the end curves are of split bamboo.

The fuselage is round at the front and tapers to a vertical knife edge at the rear. The formers for the front and for the turtle deck are made of bamboo. The stabilizer is built flat underneath and has a cambered upper surface. It is set at zero degrees incidence.

The chassis is of the ordinary Vee type. The Vees are of spruce ⅞ x ¼″ streamlined. The axle is ¼″ brass tube, sprung with rubber, and fitted into a recess in the wooden spacer. The wheels are 5½″ in diameter; they are made of thin wood and have aluminum plates on each side for hubs.



The compressed-air driven model designed and constructed by Walter J. Addems. It has a span of 8 ft. 3 in. and flies 180 feet with 100 lbs. pressure

Technical Department

Not to let any one get ahead of us, we have decided to start a technical department and answer any question which our readers may ask us. We were exposed to a good education, part of which took, and therefore we feel quite qualified to start this department. The only rules we make are as follows: Questions must be written in green ink, on both sides of the paper and addressed to the "Aeronitis Department of AERIAL AGE." We will answer all questions absolutely free of charge provided that a fee of one dollar accompanies each letter. We present the first batch of answers, thinking that our readers may be interested.

L. O. J.—Yes.
M. N. B.—No.
K. H. F.—Certainly.
U. I. P.—Depends upon the size of the pilot's shoes.
O. P. J.—Generally not.
Y. U. D.—In a biplane, yes, but not in a spherical balloon.
Y. B. S.—The latter is usually the case but more often the former.
P. R. S.—Your dollar was missing.

Would you say that a famous swordsman was one with "Dual Control"? (Don't give it up—it's tricky.)

Reggie.—I see all the saloons are using Dep. Control.
Charlie.—Where do you get that stuff?
Reggi.—Well, hasn't each saloon a foot-bar?
(The verdict was "Killed in self-defense.")

A Few Technical Predictions

As almost everybody else in this country is making technical discussions as to the trend in aircraft design, we have decided that there is no reason on earth why we should not do it ourselves. And what is more, we are willing to bet almost everything we have, including the family jewels, that not one mistake may be detected in our article.

In the first place, we predict that rotary engines will continue to be popular with those engineers who prefer a rotating engine. For those that prefer the upright engine, it is more than likely that the four, six, eight, and twelve-cylinder engines will remain popular. We feel safe in announcing that, as far as we are aware, gasoline will continue to be the chief fuel of the aeronautic engine.

Until a satisfactory substitute is discovered, crankshafts will be used in all motors.

The aeroplane will continue in popularity, and there is no reason to believe that the helicopter and ornithopter will succeed the aeroplane. We predict that the flight around the world, without landing, will not be made this year.

And last of all, we predict that if we don't beg, borrow or steal some funny stuff in the near future, either this publication will go to rack and ruin, or we shall lose 1/12 dozen good jobs.

The arrival of the 6.15 Express from Europe

Answers to Correspondents

F. E. (Boston):
No, a hog's hair brush would not do for doping the engine.

S. O. S. (Brooklyn):
No, it is not true that Blimps lay eggs.

When is an aeroplane over-stable?
When it's a loft.

Why are banana skins like pupils?
They both mean slip up, backwards.

Super Aeronautics

On the wings of birth
We flew to this earth
From the Fountain of Life on high;
On the wings of death,
When we've spent our breath,
Through infinite space we'll fly.

Perchance up on Mars,
Then more distant stars,
And world's and world's without end,
'Round orbits we'll race
With incredible pace
And thus our eternity spend.

But during our flight
On earth day and night,
On her orbit around the sun,
Let us sing the praise
Of God's flying ways,
For His ways are second to none!

Frank J. Rosenberg.

Height of Efficiency

Master Sergt. Taylor to Shop Foreman: Say, Sarg., how quick can you rig up another ship for night flying?

Shop Foreman to Taylor: Hades, man, you have three now!

Taylor to Foreman: Yes, but one is out of commission.

Foreman to Taylor: How so?

Taylor: It has a broken light bulb.

"Boy, page Mr. Deputy."

A regimental band was about to be organized at one of the war-time cantonments and, after the first reheasal the officer in charge was signing up the candidates.

"Your name?" he asked the trombonist.

"Sam Jones," returned the embryo trombonist.

"Your station?"

"Camp Devens."

"Your rank?"

"I know it," sighed Sam.

Sweet Young Thing—"What do those stars and things on your badges mean?"

Shavetail—"Those stars? Why, those stand for engagements."

S. Y. T.—"You horrid thing! Engaged to three girls! Good night!"

(*Concluded from page* 291)

of aeronautics in the national government at Washington, both as a matter of safety and economy. Had such a department been established we already would have had meteorological service specialized in forecasting for aviators, as well as a complete system of wireless communication that would have kept pilots of aircraft fully informed of the approach of storms.

In this case ample warning of the storm would have been flashed to Lieutenant Ames, and he would have gone to an altitude of more than six thousand feet or else have landed at the first convenient field. An aeroplane, if it is high enough, can safely weather a storm in the air. Should a sudden gust of wind throw it into a spin or a side-slip its pilot can always emerge from his perilous position, provided he has sufficient air room. Had we a comprehensive code of Federal aerial laws covering every phase of air navigation, the flying ambulance probably would not have been allowed to take the air under the conditions of its fatal flight.

When we consider also the recent tragedy at Paterson, N. J., in which a woman passenger and the pilot of an exhibition machine were instantly killed as a result of a crash, the need of air laws becomes even more apparent. Three separate investigations into that fatal accident have just been completed. They show that the machine was one built during the war for training purposes, and that it had been in four previous crashes. It had been repaired by amateur mechanics and had been left standing unprotected through the winter months.

In all of the countries that have ratified the international air navigation convention and also enacted local air laws no machine can take the air under any circumstances until it has received a certificate of air-worthiness, much in the same manner as a steamship must obtain a certificate of sea-worthiness before it is permitted to carry passengers on the high seas. In addition to this no pilot is permitted to fly until after he has passed rigid mental and physical tests, as well as tests of his ability to pilot aircraft of many types.

At the present time we are the only civilized nation in the world which does not regulate its flying commerce. Any one can go into the air and endanger the lives of his fellow men by flying low over cities without any restraint of law (with the exception of the ordinances of New York and Newark). He becomes amenable to law only after damage has been done. —*New York Tribune.*

AERIAL AGE WEEKLY

VOL. 13, No. 14 JUNE 13, 1921 10 CENTS A COPY

Airscape of Tulane University, New Orleans. Photographed by Aerial Photographic Co. of America, Boston

A Way to Safer Flying

PUBLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
Subscriptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, *at the Post Office at New York, N. Y., under the Act of March* 3, 1879.

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIII — NEW YORK, JUNE 13, 1921 — NO. 14

A WAY TO SAFER FLYING

WITH seven people killed outright in the Morganstown accident and fifteen injured Sunday at Milwaukee in the course of a silly exhibition at the fair grounds there, congress is justly agitated about the dangers of flying. Flying is becoming more and more common. Its death toll is not yet large, but bids fair in time, unless reduced, to rival that of railroad, ocean, and motor traffic.

Uufortunately for congress, it must be said that those interested in the making and flying of aeroplanes have been almost the sole champions of aerial law, the inspection of aeroplanes, and the regulation of air traffic. Their pleas, if granted, would doubtless have prevented the collision at Milwaukee between aeroplane and grand stand. They might have led to a condition which would have prevented the accident to the Curtiss Eagle. The wreck of this machine was apparently unavoidable, granting the presence of the machine in the terrific storm it encountered, and granting its elevation of 150 feet. As Charles F. Marvin of the United States Weather Bureau pointed out, the prevention of disasters such as it met lies in the more careful development of air roads and the use of flying reports made by trained meteorologists.

If congress assumes the responsibility which cries for assumption, it will have two tasks before it. One will be the creation of a competent corps of inspectors. These men will seldom have the duty rather wildly attributed to them by some excited writers on the recent accidents. There is little question of selecting "sound" and "unsound" designs in aeronautics today. While it is true that any one can build a plane and try to fly it, such companies as are now producing aircraft turn out scientifically planned and tested machines. The question of whether a standard type like the Eagle is fit to be flown is about as silly as the question of whether a Rolls-Royce or a Pierce-Arrow can turn corners. Whatever inspection we get, while it will naturally exclude aeronautical absurdities, will have more to do with the condition than with the lines of a machine which will always within limits be a matter for opinion. Such inspection would prevent aeroplanes in poor condition from taking the air, and would cut down many accidents.

Congress will also have the problem of improving air facilities. To prohibit flying even to save a risk of life would be impossible as to prohibit rail or ocean traffic for the same reason. We must permit it, as we have permitted it in the past, but we can make reasonable laws for it, and we can assist in making its progress more rapid. At present the need is for landing fields, cheaper and simpler instruments for flying, and for communication between aeroplanes and air stations and a regular and dependable weather service.

General Mitchell believes that the progress represented by these things can be realized best through the creation of a central department of the air. A great deal can be said for his idea. Our present half dozen bureaus and services are operating at cross-purposes. The problem of flying must be attacked by some governmental body which can bring intelligence and energy and force to bear upon it. For the development of civil flying, at least, some central agency would seem to be a logical and humane solution of a distressing situation.—(*Editorial in N. Y. Globe.*)

Air Mail Service Reform

POSTMASTER-GENERAL HAYS in his effort to clean up the air mail service mess which he inherited from Burleson appears to be striking swiftly but carefully. The suspension of several officials at Chicago and the immediate abandonment of all the lines except the transcontinental are indications of the bad conditions which Mr. Hays found in the service.

Mr. Burleson's much touted flying mail was expensive, almost unnecessary so far as the delivery of letters was concerned, and, worst of all, was killing men by the score. Poor machines, poorly inspected, meant death to the fliers. The investigation conducted under Postmaster-General Hays's direction has already proved what was said in these columns a year ago—that there was no progress in the service as it was conducted.

In a statement issued this week the Post Office Department admits that the short routes "are very expensive to operate and do not materially improve the mail service over service that is in effect on the fast trains." That is exactly what the *New York Herald* said. A New York business man wishing to send a letter from here to Washington found the railroad mail the more efficient and trustworthy.

The air mail was expected to be of benefit to aviation in general. In the past it has accomplished nothing in that line. In future it may if scientific methods are used. But the service must not be used as it has been, what with trying to make bad machines into good ones. It must have good machines and then try to find ways to improve them in safety, strength and speed. The transcontinental route is long enough and varied enough for every possible experiment.—*Editorial in N. Y. Herald.*

The News of the Week

Cloudster to Attempt Trans-Continental Flight

New York.—David R. Davis, of Los Angeles, and Eric Springer, chief pilot for the Davis-Douglas Company of that city, will attempt a non-stop flight from Los Angeles to New York late this month or early in July, the Manufacturers Aircraft Association announced June 5. They will fly the "Cloudster," a giant plane especially designed for the trip which will take them over the 2,500 miles airline separating the coasts. If they succeed in their attempt, they will have broken the world's record for distance in a non-stop flight made by Alcock and Brown in their 1940-mile trans-Atlantic flight in 1919, and also the world's duration record of 24 hours and 19 minutes held by the Farman Goliath. Davis and Springer believe it will require approximately 30 hours for them to reach New York without stopping en route.

The machine was designed by Donald W. Douglas, President of the Davis-Douglas Company of Los Angeles. It is a tractor biplane with a 400 h.p. Liberty motor, and has a wing spread of 56 feet, is 35 feet long and stands 13 feet from the grounds. Empty, it weighs 3,800 pounds. It is entirely of American design and construction, even the wing curve being of recent American development.

The "Cloudster" is equipped with huge tanks holding 660 gallons, or more than 2 tons of gasoline. Fifty gallons of lubricating oil are also carried. This fuel, tests have shown, will carry the plane at a crusing speed of 85 miles an hour for 33 hours, or 2,800 miles.

The machine will carry big landing flares and rockets, along with navigation lights and the latest instruments for flying at night. Each occupant will wear a parachute. The fuel tanks are so arranged that they may be released and dropped from the machine if a forced landing is imperative, thereby, by decreasing the weight, cutting down the speed to about 36 miles an hour and enabling the plane to alight in a comparatively small space.

Davis and Springer plan to set out in the early morning of a day when the weather bureau reports favorable winds across the continent. They will rise to an altitude of 12,000 feet over the mountains. They hope to reach the plains of the Middle West that evening, following the route of the Santa Fe Railroad to Kansas City, and thence straight to New York, arriving at Curtiss Field, Garden City, Long Island, before nightfall of the second day.

Aerial Mail Changes

The Second Assistant Postmaster General States that it is contemplated to discontinue the St. Paul-Chicago and St. Louis-Chicago air routes at the end of June.

When this is done it will restrict the Air Mail Service operated by the Post Office Department to the Trans-Continental route, from New York to San Francisco, which will be kept in operation during the coming year.

When the Air Mail Service was first organized it was planned that it would be rapidly extended in various directions and the New York-Washington, St. Paul-Chicago-St. Louis routes were to be parts of airways that would extend from the northern part of the United States to the southern part.

At the present time, due to the need for economy and lack of necessary appropriations, no further extension of the Air Mail Service is possible, and on that account the Department does not feel justified in attempting to continue operating these short routes which are very expensive to operate and do not materially improve the mail service between these cities over service that is in effect on the fast trains; this in consideration of the fact that up to the present time it has not been possible to develop night flying to a point where mail planes can be operated at night.

The following changes of personnel were made on June 1st:

Louis A. Johnson from Post Office Inspector of the New York Division to Inspector-in-Charge at Atlanta, Georgia.

C. Riddiford from Inspector-in-Charge, Atlanta, Georgia, to Spokane Division.

Robert H. Barclay from Inspector-in-Charge, Spokane Division, to St. Paul Division.

E. L. Jackson transferred from St. Paul Division to Chicago Division.

Airship Guides Traffic at Derby

A new idea in traffic direction was introduced at the recent Derby in England when the giant airship R-33 hovering over the course, kept a lookout for traffic tangles and wirelessed instructions to police along the roads. The scheme worked to perfection.

Aeroplanes co-operated with the central "cop" in the airship.

U. S. Balloon Team Selected

Ralph Upson, New York pilot, and C. J. Andrus, chief forecaster of the United States Weather Bureau, who won the national balloon race at Birmingham, Ala., last month, were designated as one of three teams to represent the United States at the Gordon Bennett balloon races at Brussels in September.

The Aero Club of America in making the announcement said the personnel of the other teams would soon be made public.

Awards in Ship-Board Plane Design Competition

The Secretary of the Navy has approved the final awards under the Navy competition for ship-board aeroplanes. The first awards goes to the Dayton-Wright Company, whose designs will be purchased for \$16,000; the second award went to G. Elias and Bro., Inc., who will receive \$10,000 for their design; the third award was to the Curtiss Airplane and Motor Corporation, whose design will be purchased for \$5,000 and the fourth award was made to Alexander Klemin, whose design will be purchased for \$3,000.

The Board who passed on the designs was composed of the following officers: Senior member, Commander Jerome C. Hunsaker, Construction Corps, Aviation Section; Lieutenant Commander Sidney M. Kraus, Aviation Division, Bureau of Engineering; Lieutenant Commander Wadleigh Capehart, of the Material Section, Naval Operations (Aviation); and Lieutenant Raymond D. MacCart, Construction Corps, Aviation Section, as recorder.

At the preliminary competition the designs of the four concerns above mentioned and A. L. Morse, of the Massachusetts Institute of Technology, were judged of sufficient merit to compete in the final competition. The Board convened on May 24th to examine the designs under the final competition, with the results given above.

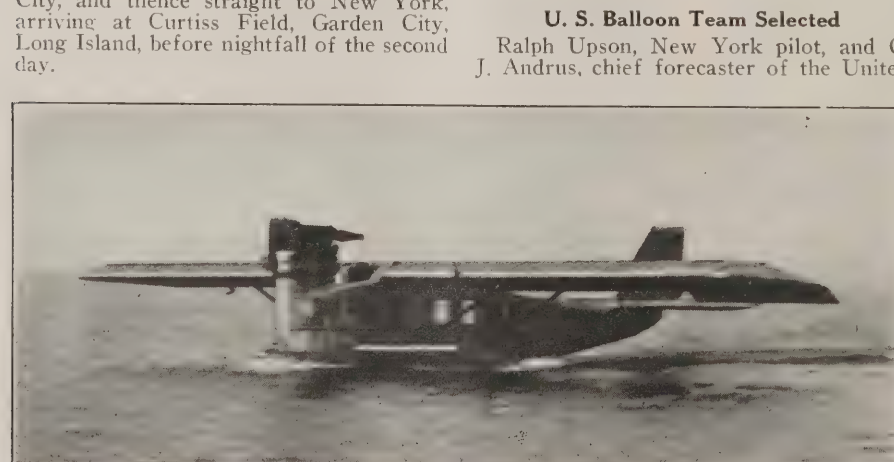
The Board states that in their opinion, while useful information has been obtained from all five designs and the competitors have shown a praiseworthy zeal in attempting a difficult problem, that the designs of the Dayton-Wright Company and G. Elias and Bro., Inc., are sufficiently promising to warrant experimental construction at this time, and the Board recommends that negotiations with these firms be made at once with a view of arranging a contract for the construction of sample aeroplanes for experimental flying tests on ship-board.

It is expected that these planes will solve the difficult problem of providing the Navy with ship-board planes for taking-off and landing on ships and also on the surface of the water.

Aerial Mail Investigation

The Second Assistant Postmaster General makes the following announcement:

The committee of Post Office inspectors, working under the direction of the Chief Inspector, Rush D. Simmons, who have been investigating the conduct of the Air Mail Service, made a preliminary report May 27th in connection with the situation at Checkerboard Flying Field, Chicago, in which they recommended the removal of Eugene W. Majors, Superintendent, Air Mail Service, Chicago; S. Murray Moore, Assistant Superintendent, Air Mail Service, Chicago; Paul L. Dumas, Field Manager, Chicago; Carl Nickell, Purchasing Agent, Chicago; Paul B. King and Daniel



All metal Dornier Flying Boat built by the Zeppelin Works. It has accommodation for pilot and six passengers

A. Martin, Employees, Air Mail Service, Chicago.

The investigation disclosed that there had been considerable incompetency in connection with the service, and drunkenness and disgraceful conduct on and off the field, in which the above mentioned men were involved.

A permanent organization has not yet been selected for the Chicago Field, which at the present time is being handled by Carleton Parker, who formerly was in charge of the Repair Depot at Bustleton, Pa.

The Chief Inspector is continuing his investigation of the Air Mail Service and will make final report within the next two or three weeks on conditions at other points. It is not thought, however, that there will be any further situations found wherein it will be necessary to take such sweeping disciplinary action as at Chicago.

Seeing New York by Air

One more way of "Seing New York" was added to the countless methods already in vogue with the inauguration, June 5, of the first sightseeing air busses of the Aeromarine Airways, Inc.

While thousands of strollers on Riverside Drive looked on, the first of the three flying boats used by the company took off on the Hudson River at Eighty-second Street. The flying bus, carrying four passengers, a mechanic and a pilot, flew up and down the Hudson over the upper bay, up the East River and around Spuyten Duyvil and back to the starting point.

The three busses, which were in operation throughout the afternoon, carried scores of guests of the company over the air route, which gives an unusual and distinctive view of the city obtained by no other method of sightseeing.

The inaugural flight started from the ocean-going yacht *Wadena,* which is moored in the Hudson at the foot of Eighty-second Street. Here Inglis M. Uppercu, president of the Aeromarine Plane and Motor Company; Charles F. Redden, president of the Aeromarine Airways Company, and C. J. Zimmermann, chief test pilot for the Aeromarine Airways, Inc., and others welcomed guests of the line.

Owing to altitude, it is possible for an observer from one of the flying busses to see not only the docks and waterfront, but also the big features in the center of Manhattan. Central Park, Broadway and other landmarks are seen from an entirely new and interesting viewpoint.

Irwin Aircraft Corporation

The Irwin Aircraft Corporation are distributors for the Curtiss Aeroplane and Motor Company, with offices in the Brunswick Building, Irwin, Pa. The activities of this company include passenger carrying, flying instruction, aerial advertising and exhibition flights.

The Martin Planes in Bombing Tests

In an effort to acquire as many large bombing planes as possible for the joint Army and Navy bombing tests to be conducted off the Virginia Coast, beginning June 21, the Army Air Service recently gave ten Army aeroplanes to the Aerial Mail Service in exchange for the Martin Mail Plane No. 202.

Although Plane 202 has been in the Air Mail Service since November, 1919, and has to its credit a record of 25,608 miles, flown at an average speed of 90 miles per hour, it is now at the plant of the Martin Company in Cleveland undergoing alterations which will transform it into a modern bomber.

Of the armada of a hundred or more planes to be used in the forthcoming bombing tests to determine the effectiveness of aerial attack against battleships, the majority of twin-motored planes will be Martin Bombers and Martin Navy Torpedo Planes. The latest type of Martin Bomber carries 3,000 pounds of bombs in addition to a complete armament of machine guns.

The Martin Navy Torpedo Plane carries the standard size Navy Torpedo, as well as bombs and machine guns. Both of these aeroplanes have a speed of 105 miles per hour with a cruising radius of 500 miles. The bombs used will be of the 550, 1,000 and 1,650-pound sizes.

Every eight days a huge twin-motored six-ton bomber is completed by the Martin Company. After passing its test flight it is immediately flown to Langley Field, Virginia, where the Air Service is concentrating the pick of its flying personnel and organizing the great aerial fleet that will send the nine German war vessels allocated to the United States to the bottom of the sea.

The former German vessels are the dreadnought *Ostfriesland,* the light cruiser *Frankfort,* three German destroyers, and four German submarines—the U-111, the U-117, the U-140 and the UB-148.

The Late Laura Bromwell

Two weeks ago we recorded the amazing feat of Miss Laura Bromwell in establishing a looping record for women by making 199 consecutive loops. Today it is our sad duty to record her death in an accident which occurred at Mineola on June 5 while she was attempting to loop a Canuck. Despite the warnings of more experienced pilots, Miss Bromwell looped the machine once, and was in the act of making her second when for some reason she lost control of the plane and it dashed to earth before she could regain control.

General Squier to Paris

Major General George O. Squier sailed on the *Olympic* last week to represent America at the international radio conference which is to be held in Paris.

Wichita Aerial Tournament

An aerial tournament and derby for the purpose of demonstrating the advantages of air travel for the business man was staged in Wichita May 29 and 30. Fourteen planes participated in the events and drew a crowd of 30,000 spectators. The tournament was a decided success in spite of the fact that a rain storm prevented many of the contests and stunts Monday afternoon. Prizes amounting to $500 were awarded to winners of the contests by J. M. Moellendick, oil operator and promoter of the Laird Airplane Corporation of Wichita.

Following is a list of the prize winners:

Altitude test with one passenger: First—Canadian Curtiss, Friday, Holdredge, Neb., pilot; time, 10; height, 1,800 feet. Second—Lincoln Standard, Beech, Arkansas City, Kans., pilot; time, 10, height, 1,600 feet.

Altitude test with one passenger: First—Laird Swallow, Horchem, Oklahoma City, Okla., pilot; time, 5; height, 2,400 feet. Second—Laird Swallow, Clark, Wichita, pilot; time, 5; height, 2,000 feet.

20-mile race: First—American Curtiss, Lucas, Arkansas City, pilot; time, 17. Second—Curtiss JN-4D, Wagner, Red Oak, Ia., pilot; time, 17.20.

20-mile handicap race: First—Laird Swallow, Horchem, Oklahoma City, pilot; time, 17. Second—Laird Swallow, Clark, Wichita, pilot; time, 17.20.

Take-off and landings: First—Laird Swallow, Horchem, Oklahoma City, pilot. Second—Curtiss JN-4D, Wagner, Red Oak, Ia., pilot.

Acrobatics: First — Laird Swallow, Horchem, Oklahoma City, pilot. Second —Laird Swallow, Clark, Wichita, pilot.

First prize niftiest looking plane awarded Laird Swallow, Horchem, Oklahoma City, pilot. This plane is one of the first made by the Laird Airplane Company of Wichita. It has been flown 35,000 miles in every state in the union and through Old Mexico.

Official Record of Finish of the National Balloon Race from Birmingham, Alabama, May 21st, 1921

	Pilot and Aide	*Name of Balloon*	*Landed at*	*Miles Traveled*
First	Mr. Ralph Upson, Pilot Mr. C. G. Andrus, Aide	"Birmingham Semi-Centennial"	10 miles west of Stuart, Virginia	423
Second	Mr. Bernard Von Hoffman, Pilot Mr. Hugo Mueller, Aide	"Riverview Club of St. Louis"	15 miles northeast of Carthage, Tenn.	201
Third	Mr. Wade T. Van Orman, Pilot Mr. Willard P. Seiberling, Aide	"City of Akron"	4 miles east of Lebanon, Tenn.	187
Fourth	Mr. H. E. Honeywell, Pilot Mr. J. M. O'Reilly, Aide	"St. Louis Chamber of Commerce"	1 mile south of Hermitage, Tenn.	182
Fifth	Mr. John Berry, Pilot Mr. Charles A. White, Aide	"Atascadero, Cal."	7 miles north of Smyrna, Tenn.	176
Sixth	Mr. Roy F. Donaldson, Pilot Mr. W. E. Robinson, Aide	"City of Birmingham"	10 miles southeast of Nashville, Tenn.	173
Seventh	Mr. J. S. McKibben, Pilot Mr. C. W. Merrell	"St. Louis No. 5"	4 miles west of Columbia, Tenn.	144
Eighth	Lt. Col. Frank P. Laim, Pilot Maj. Oscar Westover	"U. S. Army Balloon No. 1"	6½ miles east of Columbia, Tenn.	143
Ninth	Lt. Comdr. L. J. Roth, Pilot Lt. H. E. Halland	"U. S. Navy"	8 miles east of Laurenceburg, Tenn.	119

The AIRCRAFT TRADE REVIEW

Curtiss Report on Aeroplane Accident

New York.—C. M. Keys, President of the Curtiss Aeroplane & Motor Corp. issued the following statement concerning the aeroplane accident in which seven persons were killed:

"I have notified the proper officers of the Government that we desire a full investigation into the character of the Eagle and that we hope the findings of this investigation will be made public.

"We have complete faith in the ship, and are willing to rest upon the testimony of the many Army and civilian fliers who have flown it during more than a year of safe and successful operation."

Following receipt of report on the Curtiss Eagle accident, made by W. L. Gilmore, chief engineer of the Curtiss Aeroplane & Motor Corp., Glenn H. Curtiss authorized the following statement:

"This accident reveals with tragic emphasis the chaos in which American flying is involved. It would not have occurred had there been in existence a properly charted route and sufficient emergency landing fields or if, lacking these, the properly centralized machinery for gathering and disseminating storm warnings had been in existence and functioning. We must co-ordinate our flying and place it under responsible control.

"W. L. Gilmore, chief engineer for the Curtiss Aeroplane & Motor Corp., after conferring with Army officers and others, has submitted his report. Judged from the condition of the wrecked plane, from the testimony of witnesses and from the experience of Capt. B. S. Wright, during the same storm, the following appears to have occurred:

"The Eagle was in perfect flying condition. All controls were intact and in working order. On the trip to Langley Field it carried about 2,400 pounds useful load and on the return about 2,000 pounds. Its maximum capacity is over 4,000 pounds. Therefore the machine was not overloaded. The gale was blowing at probably 90 or 100 miles an hour. The pilot searched for a place to land. Although the route between Langley Field (Hampton, Va.) and Bolling Field (Washington) is heavily traveled, the route is not charted and no emergency landing fields have been established. Consequently the pilot, fighting the storm, had to make the best landing possible under the circumstances. He circled Morgantown, headed into the gale, throttled his engine and aproached a field surrounded by heavy trees 30 or 40 feet high. The velocity of the wind was so terrific that the crests of the trees were bent over like wheat.

"What occured then is deduction. Captain Wright, with a light, maneuverable and heavily powered plane, skimmed the bowed tops of the trees surrounding another field about seven miles distant. He reports that the gale, flowing over the cleared ground and up and over the trees, created an air current similar to a huge and powerful swell at sea. His plane at first dipped, then rose, then was caught under the tail and sent diving earthward. This plane, a Fokker, has such speed and such maneuverability, that it was possible to right it partly before it struck. The result was that only the undercarriage was swept off. Still having flying momentum, Wright rose, then dipped and landed on his nose, but with such reduced speed as not to seriously injure himself, although his plane turned turtle and was wrecked.

"From Captain Wright's experience, under similar circumstances, it is believed that the Eagle, coming over the tree-tops, encountered the upward stream of air. The pilot undoubtedly increased his power and elevated the plane. The terrific gale then must have caught the Eagle under the tail and sent it nose down. Although not overloaded, the Eagle, because of its size, was slower than the Fokker to respond to the controls, with the result that it crashed into the earth at a speed of probably over 100 miles an hour."

Michigan Aero-Service Corporation

The Michigan Aero-Service Corporation has recently been organized with Mr. Harold P. Ayres as manager. Headquarters at Lansing, Mich., and branch offices at Detroit, Jackson, Battle Creek and Muskegon. The activities of this company include aerial photography and advertising; passenger, cross-country and exhibition flying and flying instruction.

Air Service Contracts

Field Compressor Unit—Air Service, Munitions Bldg., Washington.—Bids are wanted until 2:30 p. m., June 15, circular 98, for furnishing 1 field compressor unit.

Envelopes for Kite Balloons—Air Service, Munitions Bldg., Washington.—Bids are wanted until 2:30 p. m., June 22, circular 102, for furnishing 30 envelopes for kite balloons.

Envelope for Airship—Air Service, Munitions Bldg., Washington.—Bids are wanted until 2:30 p. m., June 14, circular 95, for 1 envelope for U. S. Zodiac airship.

Rubber Cement—Air Service, Munitions Bldg., Washington.—Bids are wanted until 2:30 p. m., June 8, circular 100, for 800 gals. rubber cement.

Iron—Little Rock Air Intermediate Depot, Little Rock, Ark.—Bids are wanted until June 10, circular 13, for furnishing 230 ft. strap iron, 240 ft. wrought iron and 324 ft. do.

Lumber—Little Rock Air Intermediate Depot, Little Rock, Ark.—Bids are wanted until June 10, circular 12, for furnishing 21,686 ft. pine lumber.

Roofing—Little Rock Air Intermediate Depot, Little Rock, Ark.—Bids are wanted until June 10, circular 11, for furnishing 13 squares slate-covered felt and asphalt roofing.

Steel and Iron Stakes—Office of the Chief Signal Officer of the Army, Washington.—Bids are wanted until June 15, circular PR 5929 B-19 CP, for furnishing 2,184 galvanized angle iron stakes and 888 steel stakes.

Cylinder-Testing Equipment—Air Service, Munitions Bldg., Washington.—Bids are wanted until 2:30 p. m., June 16, circular 97, for furnishing 2 sets hydraulic cylinder-testing equipment.

Electrical Supplies—Little Rock Air Intermediate Depot, Little Rock, Ark.—Bids are wanted until June 11, circular 16, for 10 switch conduits, 6 wall outlet receptacles, 12 ceiling outlet boxes, and 18 keyless receptacles.

Sand, Rock, and Cement—Little Rock Air Intermediate Depot, Little Rock, Ark. —Bids are wanted until June 11, circular 15, for 103 barrels Portland cement, 100 tons blue trap rock, and 50 cubic yards sand.

Nails—Little Rock Air Intermediate Depot, Little Rock, Ark.—Bids are wanted until June 11, circular 14, for 200 barrels common nails.

Rubber Blocks—Little Rock Air Intermediate Depot, Little Rock, Ark.—Bids are wanted until June 11, circular 17, for 50 rubber blocks, 6x6x2 in.

Vellum and Blueprint Paper—Engineering Division, Air Service, McCook Field, Dayton, Ohio.—Bids are wanted until June 10, circular 21273, for 100 sheets white drawing paper, 12 reams buff detail paper, 150 rolls vellum and 385 rolls uncoated blueprint paper.

Steam Road Roller—Engineering Division, Air Service, McCook Field, Dayton, Ohio.—Bids are wanted until June 10, circular 21275, for one 3-wheel steam road roller.

Carburetor Strainers—Engineering Division, Air Service, McCook Field, Dayton, Ohio.—Bids are wanted until June 10, circular 21276, for furnishing 960 carburetor strainer assemblies.

Piston Assemblies—Engineering Division, Air Service, McCook Field, Dayton, Ohio.—Bids are wanted until June 10, circular 21274, for 40 piston assemblies for model W-2 engines.

Airship Docking Trolley—Air Service, Procurement Office, Munitions Bldg., Washington.—Bids are wanted until 3:30 p. m., June 16, circular 104, for 8 carriers for airship hangar docking rail system.

Switchboard Cords, Etc.—Office of the Chief Signal Officer of the Army, Washington.—Bids are wanted until 11 a. m., June 13, circular PR 5929-A-1CP, for furnishing 1,000 switchboard connecting cords, 1,100 do, 250 extension cords, 2,100 do, 250 do, 264 do, 350 do, 250 do, and 1,000 switchboard connecting cords.

DESCRIPTION OF THE McCOOK FIELD WIND TUNNEL

Purpose of the McCook Field Wind Tunnel

The McCook Field wind tunnel is used for high-speed investigations of instruments, airfoils, etc. The design is not conventional inasmuch as considerations of speed and efficiency demand departure from the accepted type, where the work is done on models varying from 1½ to 3 feet span, at speeds of 30 to 60 miles per hour.

Speed of the Wind Tunnel

Speeds up to 525 miles per hour are attained. The pressure, density, and temperature of air flow at such velocity introduce factors which are not important in conventional wind tunnels, but which must be taken into account here.

Problem of Scale Effect

It has been customary since the empirical data of the 1912 report of the N. P. L. to apply certain rough corrections when using laboratory coefficients for full-size work. The assumption has been that in any geometrically similar aerodynamic bodies the coefficients will remain the same if the products $\frac{VL}{v}$ remains constant; and if this product does not remain constant corrections must be applied in scaling from one value to another. The entire realm of aeronautical laboratory investigation is at the present time subject to uncertainty regarding the above-mentioned scaling effect.

Laboratory data on wings, propellers, etc., when applied to full-size design has been interpreted in terms of the product VL, on the assumption that v is constant as between the model and full-scale experiment. To a certain extent this practice is justified, but as a solution of the laboratory method of attack it has been supported rather by theory than by any large amount of empirical data.

It is found in certain typical investigation at McCook Field that the above practice is not altogether adequate for the deduction of aerodynamic characteristics where the range of speed exceeds those which were conventional in 1912.

Results of the McCook Field Wind Tunnel

The results of tests, issued in other reports, show that a wind tunnel of high velocity V and small diameter D may afford entirely different phenomena from those of a larger wind tunnel having the same dv product. Of course any wind tunnel is intended to attain the largest possible product $V \times D$, the general basis being that V is expensive in power and D is expensive in building space; and any wind tunnel is a compromise of these two expensive factors. The McCook Field wind tunnel departs from the conventional compromise to such an extent that the velocity is brought into the region of actual flight. The results attained have assisted in our interpretation of the fundamental aerodynamic laws, and especially in their application to propeller design.

Description of McCook Field 14-Inch Wind Tunnel

As in other wind tunnels, air is sucked through a horizontal tube, where it blows against a small model at known velocity. The model is supported by a rod projecting from a suitable balance into the tunnel, and the forces concerned in flight can thus be measured. The air after passing the model is decelerated in an expanding cone and exhausted into the room by a propeller fan. Description of the McCook Field tunnel need include only those features which differ from the standard type.

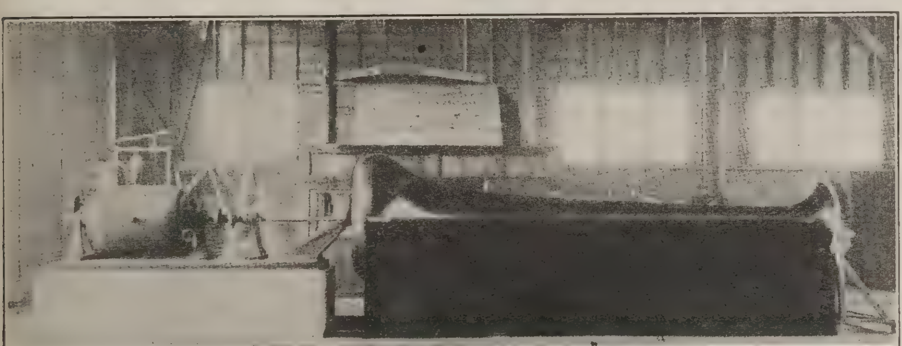


Fig. 1—General view of wind tunnel

The intake trumpet, tube, and expanding cone have the general form of a Venturi tube with a length of 18⅔ feet; the intake trumpet has a diameter of 3½ feet and radius of curvature of 22¾ inches; the throat diameter is 14 inches and the fan diameter is 5 feet. The location of the test section close to the intake is advantageous, as discussed in section 1 of this report; there is no appreciable loss of energy at the intake, and the traverse of a diameter at the commencement of the throat shows no appreciable velocity variation except at the walls. The usual honeycomb is omitted, but a 4-bladed "straightener" 48 inches long is inserted in the cone 4 feet downstream from the model, and there is a straightener outside the intake having 16 flat radial blades. The former "straightener" cuts the fluctuations of the velocity from 15 per cent down to 2 per cent. The cone is of 5° angle for the first 100 inches.

The power plant consists of a Sprague dynamometer, capable of delivering 200 horsepower for one-half hour at 250 volts and 1,770 revolutions per minute without overheating. The 5-foot fan is made with a solid center disk 40 inches in diameter, and has 24 blades 10 inches long. At the upstream side of the 40-inch disk, a bell of equal diameter is fixed in the tunnel so that the air is led up to the annular discharge opening with a minimum of eddies. (See fig. 2.)

The balances are of two types. The first one (fig. 3), designed by C. P. Grimes, measures lift and drift on two separate instantaneous-reading Toledo scales. It is mounted upon a portable carriage. The spindle for the model projects horizontally and axially from this carriage into the mouth of the wind tunnel, carrying the model at its free end. The spindle terminates in a thin, flat bar, the latter clamping a graduated disk which is rigid with the model at the center of the span. This type of balance possesses three advantages, as follows: (1) Instantaneous readings make it possible to synchronize balance and velocity observations and to practically eliminate the effect of velocity fluctuations; (2) the air forces can be qualitatively studied, as, for instance, in the case where a given set-up has two values of K_y, when the balance can be seen to change from one reading to another; (3) the method of support affords a highly accurate means of skin friction observation.

The second type of balance is of the "vector" type, invented by the Wright Bros., with improvements developed by the writer. This balance reads L/D with an accuracy superior to the ordinary type; and it reads lift and drift in terms of static pressure. The advantage of the latter feature is that the reading is deadbeat.

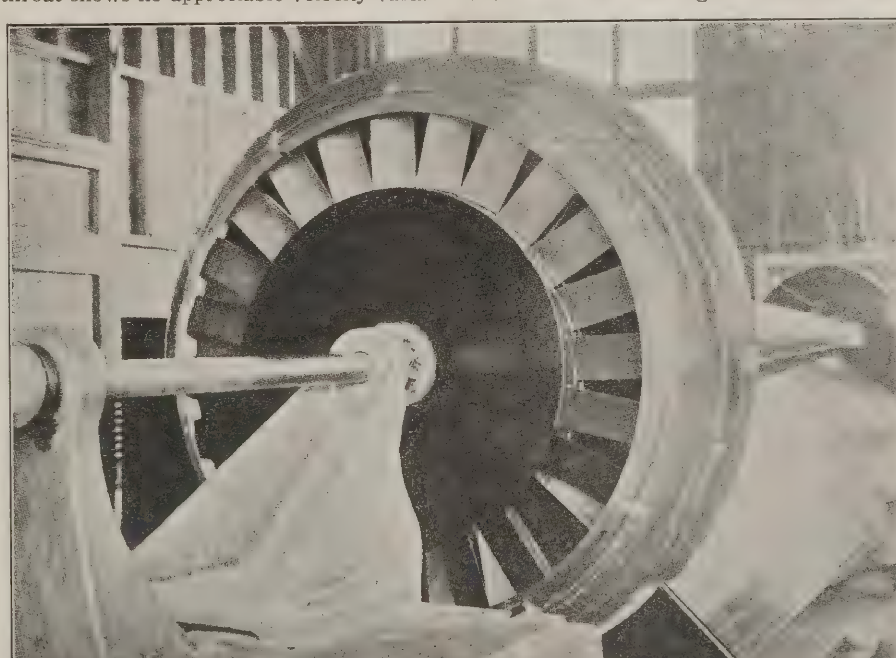


Fig. 2—Wind tunnel fan

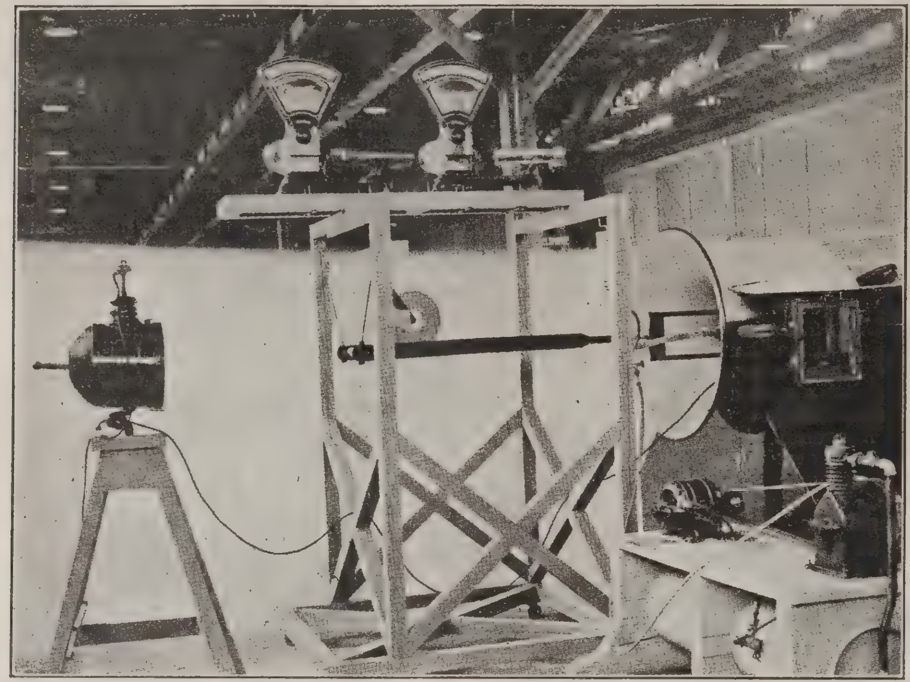


Fig. 3—Grimes type balance

Operation of the Wind Tunnel

The method of carrying out the tests consists in setting the model in the tunnel at a known angle of attack and measuring the lift and drift forces by means of the indicating Toledo scales. As the precision of these instruments is better than one-tenth per cent, they are considered sufficiently accurate for work of this kind. The three readings of velocity head, lift, and drag are taken by three different observers, the readings being synchronized by means of signals. The tunnel is run at speeds varying for each angle, from about 30 miles per hour to about 450 miles per hour; lift, drag, and velocity-head reading being taken at each speed.

In order to check up the direction of the wind in the tunnel the model is turned upside down and the run repeated with the model set at the same angle. By this means it is found that there is a fairly uniform correction of about 0.4°. This correction has not been applied to the small charts shown in K_y for a given angle at various speeds, but has been applied to the larger chart in the center showing K_y plotted against angle.

An observer at the lift scale chooses a point about which the indicator hovers, and when the pointer is so hovering he makes a signal; a second observer on the drift scale, and a third observer at the manometer then makes simultaneous observations, each observer having previously become accustomed to the respective lag between his instrument and that of the observer who gives the signal. In this way fluctuations of velocity in the wind tunnel become less important for accurate results. An automatic recording device for doing the work of the observers at once suggests itself, assuming that the various instruments are properly synchronized. The development of such an instrument has been investigated but not completed.

The tests are made with an increasing velocity; that is, the motor is started at a low r. p. m., a set of readings taken and then the motor speed increased by means of a rheostat. Occasional check runs are made with decreasing speeds. Where speeds are approached at which the flow becomes unstable, the condition is easily observed upon the balances, which may be seen to hover successively at two distinct points, the speed remaining the same.

Efficiency of the Wind Tunnel

The question of efficiency of the wind tunnel is one which was made the subject of much preliminary study. By efficiency is understood the ratio of kinetic energy of the air stream at the throat of the tunnel minus the energy absorbed by the fan, all divided by the energy of the air stream at the throat.

$$e = \frac{\dfrac{\rho}{2g} A V^3 - E}{\dfrac{\rho}{2g} A V^3}$$

where $\dfrac{\rho}{g}$ is the density, A the cross-sectional area of the throat, V the velocity at the throat, and E the rate of absorption of energy by the fan.

It is noted that this ratio differs from the conventional efficiency factor used in wind-tunnel discussions (kinetic energy at throat over fan energy). A value of 76 per cent was reached, higher than has been usual in determining airfoil coefficients in other wind tunnels.

The net blade discharge area is 8.38 square feet, which is 7.84 times the area of the choke. With a choke speed of 100 miles per hour, air was noted to leave the propeller at an angle of 45° with the plane of the fan and at an angle of 15° radially from a tangent. The component velocity was noted to be about 47 miles per hour. The average ratio of choke to exit suction throughout the above range from 25 to 465 mi./hr. is 6.5.

Noise

Careful study of fan and cone design results not only in reduced losses but also in reduced noise. In the past the noise has been a serious objection to speeds greater than 70 miles per hour in wind tunnels. It may be said that 60 per cent of the roar of any aeroplane is due to the propeller. For wind tunnel use, the combination of fan and cone adopted has brought about a considerable improvement, as indicated in the following tabulation:

From the operator's position

The fan is noiseless at	50
The fan starts to roar at	60
Conversation is easy at	125
Conversation is slightly forced at	155
Conversation is possible 12 inches apart at	240
Conversation is possible at 4 inches apart at	300

Precision

The precision of wind-tunnel work in general is dependent in the last analysis upon the velocity readings. By means of adopting the instantaneous-reading method, however, the inaccuracies usually to be expected due to velocity fluctuation have been greatly decreased, as was shown at the start of the experiments by study of the velocity graphs. The method was found normally to be very satisfactory, but under abnormal conditions, as for instance when the doors were open and the wind was blowing outside, the tests became impracticable.

The precision of any one reading depends upon the skill of the observers and on the amount of time at their disposal for identifying the fluctuations of their respec-

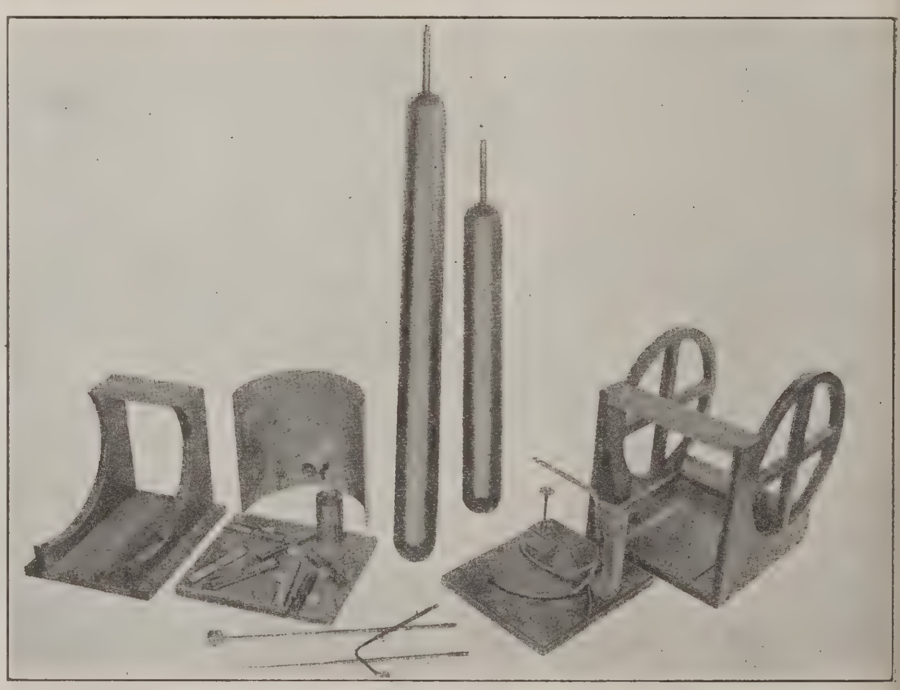


Fig. 4—Airfoils, instruments, and standards

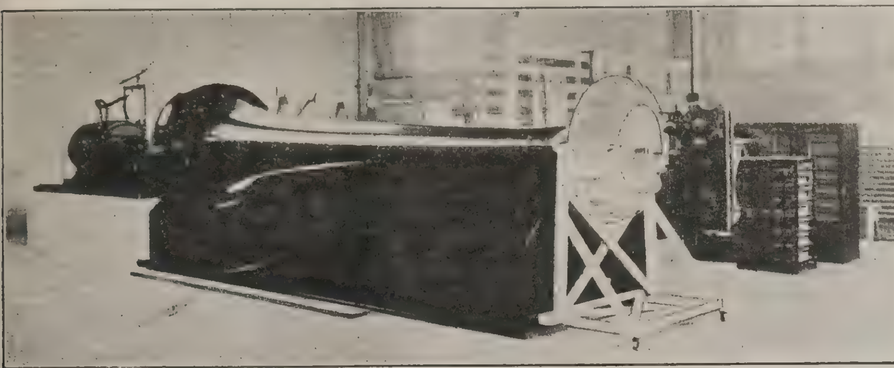


Fig. 5—Three-quarter view of wind, showing intake end, with intake straighteners in place

tive instruments. The individual readings of the tests here reported have precision slightly less than could be obtained in the conventional wind tunnel where a honeycomb is used; hence the desirability of a plurality of observations at small velocity increments. The results as plotted show the same order of precision as is reached in the conventional wind tunnel. Moreover, scaling effects of experiments so far exceeds the degree to be predicted from past knowledge of the $\frac{LV}{V}$ ratio, that it is not found LV necessary to question the adequacy of the precision.

In general no difficulty was encountered in checking a given run with different crews and on different days.

The determination of true velocity is dependent upon a knowledge of the temperature and density of the air flowing through the observation section. The temperature is calculated on the assumption that the expansion is adiabatic from the atmospheric pressure corresponding to the dewpoint, and is polytropic below the latter pressure. A correct knowledge of throat temperature is, of course, essential; and it is necessary to develop a special method of thermometry for reading it. Present methods are inapplicable to its direct measurement, for a thermometer introduced into the air stream occasions more or less adiabatic compression of the air striking it, with consequent rise of temperature at the point of impact. The most advantageous position for the thermometer is with the bulb downstream, where it is subject chiefly to skin friction rather than impact. Further investigations are being made of the matter.

For plotting graphs the usual wind-tunnel practice has been followed, wherein the density in the room rather than in the tunnel is used as a basis on which to figure velocity. This has been done for convenience in view of the complicated laws which govern the density of the air in the tunnel itself. The correction when applied does not change the value of the lift coefficient, but changes the corresponding value of the velocity.

It might be desirable to explain how the life coefficient is calculated, so that it will be apparent that the density does not enter into the calculation. Suppose that h represents the height of the water column corresponding to the velocity head at a velocity V; then, if $\frac{\rho}{g}$ represents the density of the air in slugs, $\frac{\rho}{g} \times V^2 = K_1 h$.

If P represents the lift on the model, and A its area, and K_y the absolute lift coefficient, then

$$P = K_y \frac{\rho}{g} A V^2, \text{ and } K_y = \frac{P}{\frac{\rho}{g} A V^2}$$

Substituting,

$$K_y = \frac{P}{A K_1 \times h}$$

It is evident that this last expression is independent of density, and as this equation is used in calculating the value of the lift coefficient in all cases, the density of the air in the tunnel does not affect the value of the lift coefficient.

Method of Supporting the Airfoil

The effect of the center support on the lift coefficient is not considered serious. This conclusion is based on experiments run at other laboratories where the effect of the support has been carefully determined; also on a comparison of the present series of experiments with tests made elsewhere on a larger model supported at the end, for the same VL values. The effect of the center support on drag, however, is known to be very large, so that the results on drag have not been given except in a qualitative way.

The one-end spindle used at the National Physical Laboratory can not be utilized under the conditions of these tests. In order to definitely delimit the effect of the supporting member, further developments are proposed wherein this effect will virtually be eliminated from the tests.

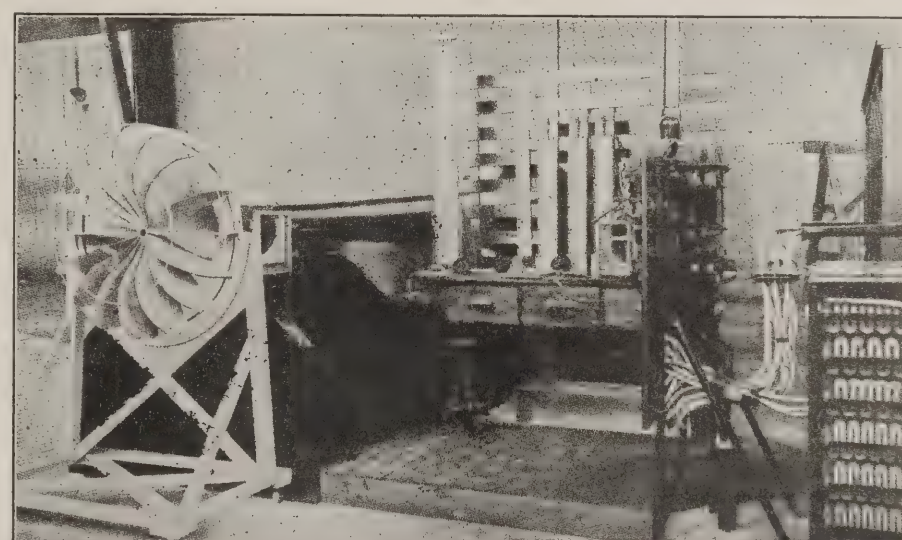


Fig. 6—View showing from left to right, intake straightener, door of experimental chamber, monometer columns, switchboard, and resistance coils

THOUSANDS OF DOLLARS SAVED TO THE PUBLIC BY AERIAL SURVEY

THE report of Capt. Lowell H. Smith, commanding the detachment from the 91st Aero Squadron which was detailed to co-operate with the U. S. Forestry service in making a survey from the air of the cyclone-swept district of the Olympic Peninsula in the State of Washington, shows that by this one performance the U. S. Army Air Service has saved the public from $125,000 which it is estimated would have been the cost of a ground survey, to possibly millions of dollars by reason of information obtained which will be invaluable for use in fire prevention in this wind-blown region.

The total time required for making this aerial survey was 68 hours 20 minutes; the total cost was $2,524. It is estimated that a ground survey would have required from two to three years, at an expense of $125,000. Meanwhile the menace of fire would have been an ever-increasing one, likely at any moment to become a reality, and so to add millions more to the work of destruction.

Capt. Smith's report in full follows:

Pursuant to S. O. No. 67, Par. 21, Headquarters Ninth Corps Area dated March 22, 1921, a detachment from the 91st Aero Squadron consisting of Captain Lowell H. Smith, First Lieutenant E. C. Kiel, Staff Sergeant Alva DeGarmo, pilots; Master Sergeant Ephraim Cornish, Staff Sergeant Burman, mechanics; and Sergeant Thomas, photographer, left Mather Field, Sacramento, California, for the Olympic Peninsula of Washington at 12:15 P. M., March 23rd, flying in three DeHaviland 4-B planes.

Severe rain and snow storms were encountered in the Trinity and Scott Mountains, making it necessary for the formation to turn back and land at Red Buff at 2:10 P. M. on a very muddy field. A stop was made here over night.

March 24th: It was raining in Red Buff, but the clouds began to break about

(*Concluded on page 326*)

AEROPLANE SUPERCHARGERS

By W. G. NOACK

Former Engineer, Board of Aeroplane Experts, Charlottenburg

(*Continued from May 30th issue*)

WITH superchargers driven direct by the main engines, and which always run at the full number of revolutions, the excess pressure at and near ground level (with the exception of the few mm. excess pressure necessary for the compensation of the power consumed by supercharger) must be destroyed by throttling, that is, the delivery of an excess quantity of air must be prevented. The most economical way is to fit the throttle in the supercharger suction pipe, as the supercharger will then deliver air of less density. Furthermore, the so-called surging is avoided, because behind the throttle expanded air completely fills the vane spaces and the supercharger works at all altitudes under the conditions for which it was designed, except for the temperature differences. The opening of the sliding throttle valve for hand operation by Brown, Boveri Co. (Fig. 6) is just large enough to permit the passage of as much air as is required by the engine when running with its full number of revolutions at ground level. The slide valve is operated by means of wires and a lever from the pilot's seat. The lever is provided with a notched guide indicating the various altitudes. For further certainty, the pilot is furnished with one of the above-mentioned low pressure gauges; the hand of the same must indicate one atmosphere or else the same altitude as the hand lever. In order to prevent the engine, before it is running at full speed, from receiving too much air and therefore exploding or stalling, and for the purpose of reducing the number of control levers, the throttles of the supercharger and carburetor may be coupled in such a way that at first only mixture is delivered. If the carburetor is quite open, and the hand lever continues to be shifted, it will stay open and it will be possible to release more air at the supercharger. When shutting off the process is reversed.

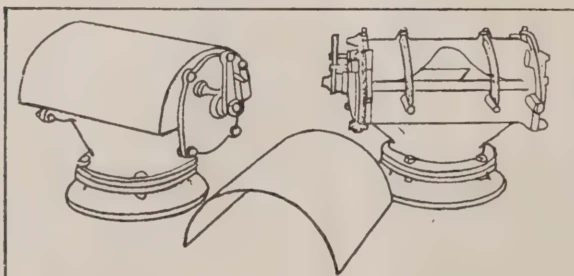


Fig. 6. Sliding throttle valve by Brown, Boveri and Co.

In place of operation by hand, automatic regulation may be substituted. This entirely relieves the pilot from controlling the supercharger. Several different forms of apparatus for this purpose, which utilize the exnansion of barometric cells under the influence of the decreasing air pressure with increasing altitude, have been proposed by the Propellerbau Lorenzen, Berlin-Neu Köln, and by Brown, Boveri & Co., Mannheim.

When the supercharger is driven by a special engine, it is practical to make the rough adjustment of the number of revolutions by throttling the mixture at the driving engine and to make the accurate adjustment by throttling the air at the supercharger. Both throttling arrangements can be manipulated from the pilot's seat, the revolution indicator of the supercharger engine being also visible from the pilot's seat. When idling the main engines, the air withdrawn from the supercharger is reduced almost to the amount required for the supercharger engine. The load of the supercharger thus drops to about ⅓; in order to prevent the supercharger from running away it therefore must be throttled at the same time as the main engines. The supercharger engine is connected to the compressed air pipe in the same way as the other engines.

With the use of a supercharger the fuel system usually undergoes some alterations. Generally speaking, in an aeroplane fuel is fed from a gravity tank (its supply being received from a main tank), or with a fuel pump, the excess from which passes back to the main tank through an excess pressure valve. The placing of the main tank under pressure is avoided in consideration of the weight and strength required (at 5 km. altitude the container would be subjected to almost ½ atmosphere of excess pressure) and also because of the danger of fire. In the simplest but most usual case (Fig. 7), the main tank itself is used as a gravity tank. The re-

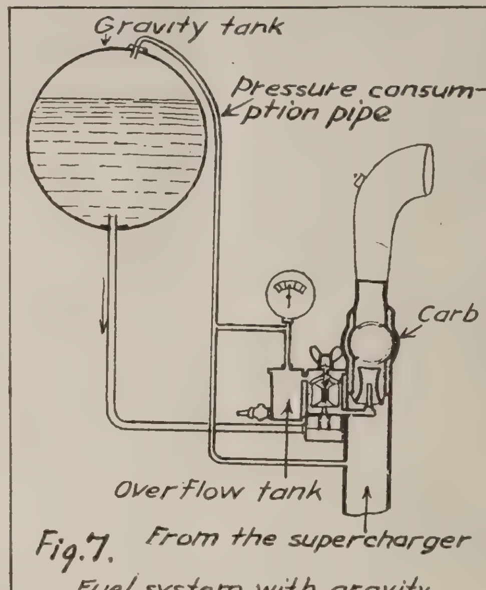


Fig. 7. Fuel system with gravity tank

quired excess pressure on the fuel at the carburetor is from 2 to 2.5 m. water column and is generated by the static pressure of the high container. The float and float chamber are subjected to the supercharger pressure, the movement of the float is thus independent of the supercharger's pressure as long as the pressure compensation can take place fast enough. For short compensation pipes (for small aircraft) 6 mm. bore is sufficient, for long ones (for giant aeroplanes) 8 to 10 mm. Special care must be taken to make the pipes and connections absolutely tight.

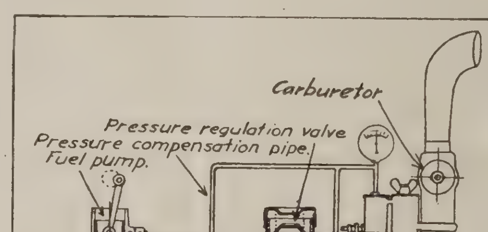


Fig. 8. Fuel system with pump.

Fig. 8 shows the design of the fuel system when employing a pump, which may be driven by the engine itself or by some

* The illustration shows the regulating valve by Benz & Co., Mannheim.

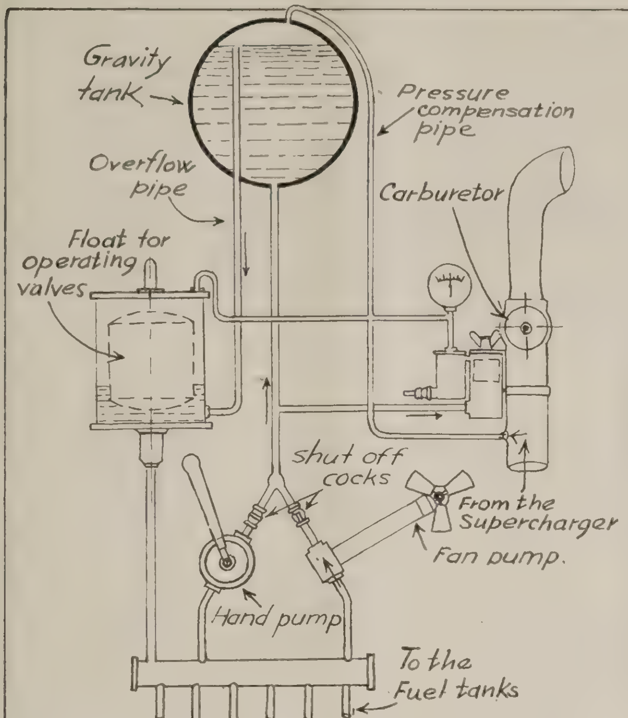


Fig. 9. Fuel system for giant airplanes.

other power and which forces the fuel from the main tank to the carburetor. If the pump delivers more than is consumed, the excess will return through the regulating valve *) which is set for between 2 and 2.5 m. water column. In order also to render the latter independent of the supercharger pressure, the overflow cup and the float chamber of the carburetor are **connected by a pressure compensation pipe.** The main fuel tanks are subjected to atmospheric pressure only. In order that no supercharger air should reach the main tank, a float valve is inserted between the overflow cup and the main tank. This float valve is also connected with the pressure compensation pipes. Its manner of action needs no explanation. The size of the float is dependent upon the fact that the upward pressure on the float valve must overcome the pressure difference acting on the shut-off valves, the upper side of the latter being subjected to the supercharge air pressure and the lower side to the tank pressure or outside pressure. The most common arrangement of the fuel system for giant aeroplanes (Fig. 9) is composed of the parts as described. Instead of the excess pressure valve, a drop tank is used there, however.

The aeroplane superchargers described below, and which were in existence at the termination of the war, were for the most part first executions of the designs and doubtless leave room for improvement with regard to weight and space requirements and also with regard to many details.

The first supercharger ** of this kind, by Otto Schwade & Co., Erfurt (Figs. 10 to 20), was designed for direct coupling to a 260 h.p. aeroplane engine and an output of 1,000 kg. of air per hour with a maximum compression ratio of $\frac{b_0}{b} = 1.52$, which corresponds to a constant engine output up to an altitude of about 3.5 km. It consists of four adjacent chambers. The first of these encloses the gear drive and each of the other three contains an impeller with its corresponding diffuser. The chambers are all co-axial and combined into a single block without horizontal joints. In assembling, an impeller and a

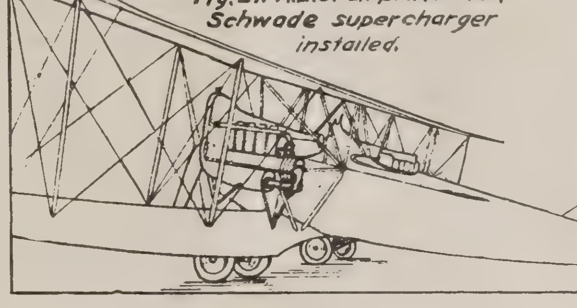
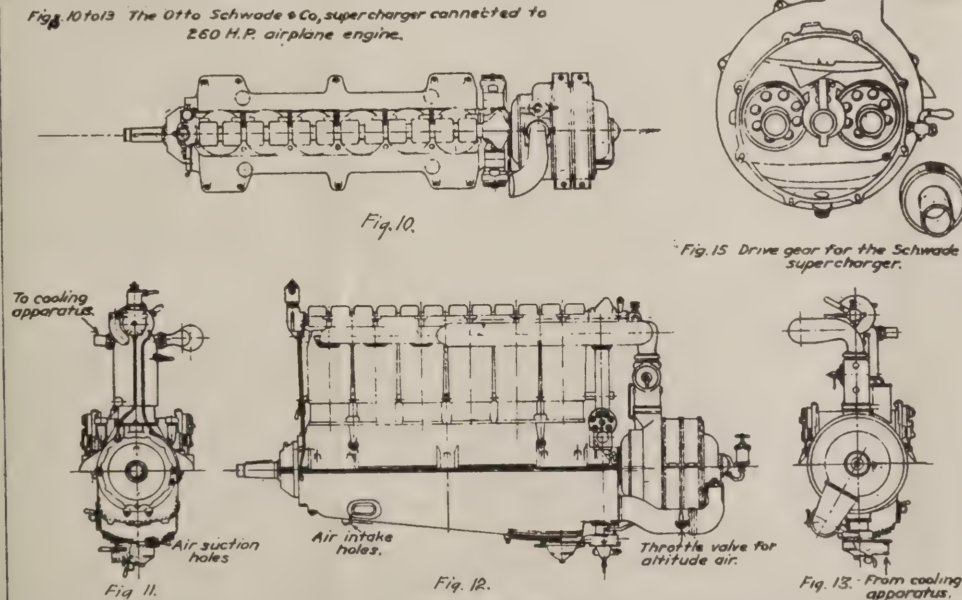


Fig. 21. A.E.G. airplane with Schwade supercharger installed.

housing are put in place alternately and the housings are held together by screws at the circumferences, while the impellers are held on the shaft by means of a nut at the thrust bearing. The chambers are made of aluminum castings, the impellers of special steel. The driving gear has two oppositely located intermediate gear sets running on ball bearings over stationary studs. The impellers revolve at 10,500 r.p.m., the driving gear at 1,400 r.p.m., and the intermediate gears at 3,500 r.p.m. With the impeller diameter of 250 mm., the peripheral speed amounts to 140 m. per second. The gear wheels are made of chrome nickel steel, case-hardened. The pinion on the supercharger shaft is built integral with a slip coupling consisting of four bronze annulus sectors which are pressed against the coupling box by centrifugal force. This coupling is intended to facilitate the starting of the engine and to protect the driving gear from the violent acceleration shocks when starting, as the coupling does not connect the impellers until the engine has attained a speed of 600 r.p.m. For lubrication of the driving gear the wheels are arranged to dip into an oil bath. Fig. 20 shows the supercharger, with the carburetor and float chamber mounted on top as well as the pressure compensation pipe connecting the float chamber with the discharge connection of the supercharger. The supercharger draws air from the bottom of the engine crankcase (which is thereby cooled), and a throttle valve is inserted in the air inlet to the supercharger so that the pressure delivered by

Figs. 10 to 13 The Otto Schwade & Co, supercharger connected to 260 H.P. airplane engine.



** German Reich's patent applied for.

the latter can be regulated. The complete supercharger with connections as first executed weighed 47.5 kg., and if we take into consideration that the weight of the 260 h.p. engine is 420 kg. and its output at 3.5 km. altitude is only 170 h.p., and that the driving of the supercharger requires 20 h.p.; then the engine without supercharger would have a unit weight of 2.5 kg./h.p. at this altitude as compared to 1.95 kg/h.p. with supercharger. Superchargers of this kind have been installed in A.E.G. aeroplanes (see Fig. 21). They are also easily combined with revolving cylinder engines (see Figs. 22 to 24). In the latter case, the supercharger takes its air directly from the atmosphere and forces it into the inlet pipe which is connected to the tubular crankshaft.

The Brown, Boveri & Co. branch in Mannheim, who even before the war had kept in close touch with their parent house in Switzerland with reference to the construction of turbo-compressors, did the most exhaustive work in connection with aeroplane superchargers. Their first model was designed for the 1,200 h.p. power plants of the giant aeroplanes (Figs. 25 and 26) and was driven by a Daimler aeroplane engine which also received its fresh air from the supercharger. With this plant the float chamber of the carburetor of the driving engine is enclosed in a box, the latter being subject to supercharger pressure (see Fig. 25), thus rendering the carburetor independent of the outside pressure. At the suction connection of the supercharger is fitted a hand-controlled throttle device (see Fig. 26). The Staaken giant aeroplanes were equipped with superchargers in the same manner (see Fig. 27). In the middle of the picture may be seen the air pipe leading to the supercharger engine and connected to the box shaped enclosure of the carburetor. The throttle valve for the mixture is hand-operated by means of a chain and sprocket control from the pilot's seat. Fig. 28 shows the construction of the superchargers used. In more recent examples of this supercharger (Fig. 29), the suction connection was removed to the driving end so that the incoming stream of cold air might aid in cooling the driving gear. Furthermore, the compressed air conduits, which in the older types had already been divided at the final cell, were, for better guidance of the air stream, now connected to the housing by a practically tangential extension. This supercharger normally furnishes 4,200 kg. of air per hr. at 0.52 atmosphere initial pressure and one atmosphere final pressure, the corresponding power consumption being 120 to 125 h.p. The speed of the driving engine is 1,450 r.p.m., and that of the supercharger shaft 6,000 r.p.m.; supercharger is of the 4-stage type, the impeller diameter being 470 mm., thus the peripheral speed is about 150 m/sec. The housing, driving gear cast, inlet pipe connection, and diffuser vanes are all cast of an aluminum alloy.

The impellers were made of special alloy steel having a tensile strength of 81 kg/sq.mm. and an elongation of 15%. The ends of the hollow shafts are made of chrome nickel steel with a tensile strength of 76 kg/sq.mm. and an elongation of 16.5%. The gears and pinions are of chrome nickel steel from the Bismarck Works. The bearings at the rotor pinion are subject

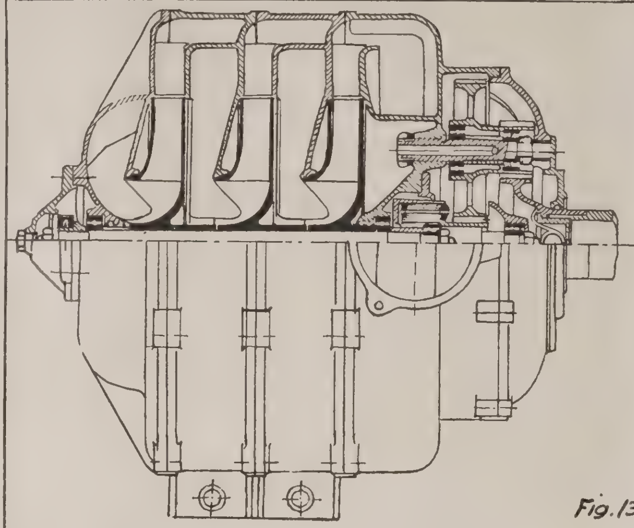


Fig. 14 Schwade supercharger.

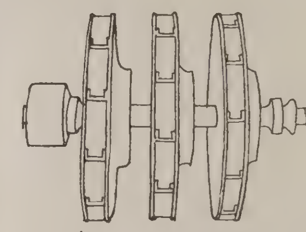


Fig. 17. Impellers

Fig. 13 Parts of the slip coupling.

Fig. 16 The diffusor.

Fig. 18 Impeller with one side removed

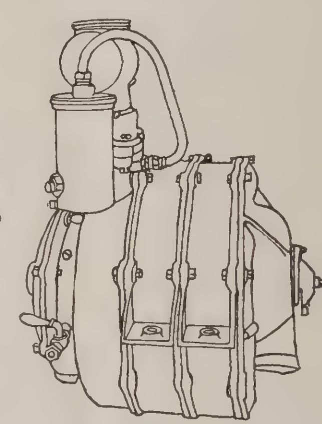


Fig 20 Schwade supercharger with carburetor mounted on top.

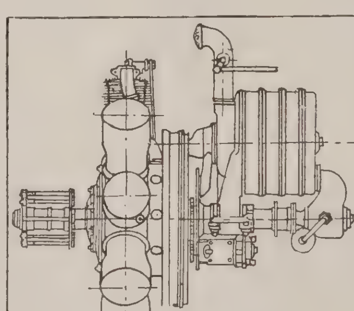


Fig. 22.

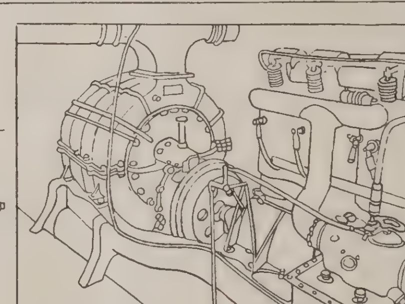


Fig. 25. View from the engine end.

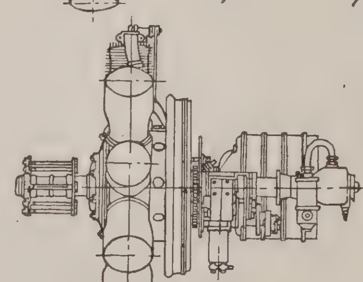


Fig. 23.

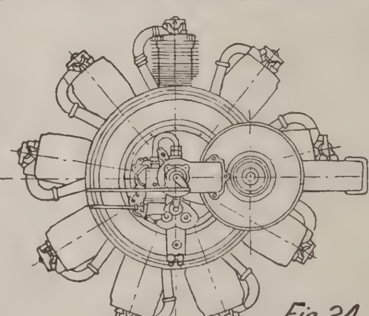


Fig. 24.

Figs. 22. to 24. Revolving cylinder engine fitted with schwade supercharger.

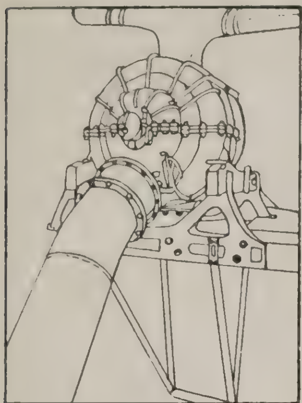


Fig.26. View from the suction end

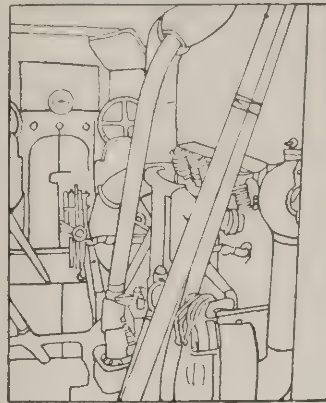


Fig.27. Supercharger plant in center gondola of a staaken the giant airplane.

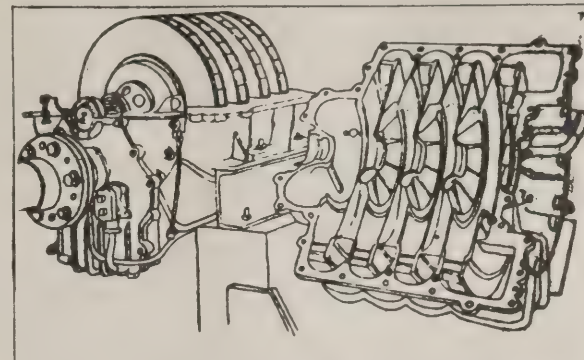


Fig. 28. Brown, Boveri and Co. supercharger for a 1200 H.P. engine plant.

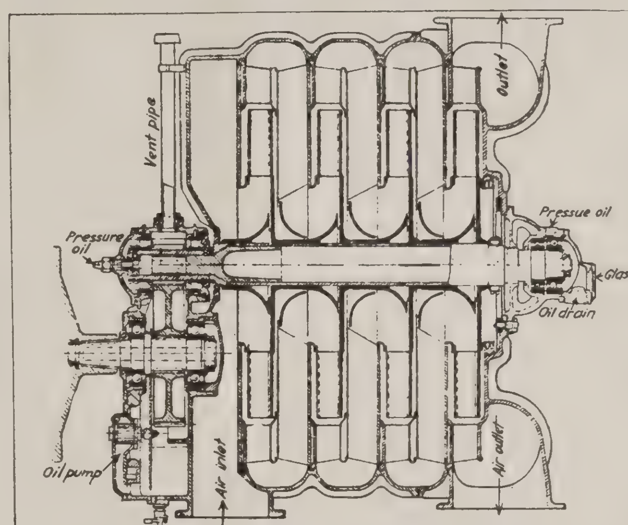


Fig. 29 Recent type of airplane supercharger, Brown, Boveri and Co, for a 1200 H.P. engine plant.

to great stress and are roller bearings by the Norma Co. The gears were executed with especial care.*

The driving wheel has 54 teeth and the pinion 13 teeth with circular pitch of 4.05 π and a face width of 50 mm. When transmitting 125 h.p., the teeth are loaded to c = —— = 113 kg/sq.cm.[2]. They are case-hardened and ground on Maag machines. Oil is injected directly between the teeth through two nozzles of 2 mm. diameter, being circulated by a gear pump driven from the small slow-speed shaft. The supercharger is connected to the engine crankshaft by a leather block joint (Voith coupling). The complete supercharger with its drive weighs 145 kg. The coupling with a disk flywheel mounted thereon, which has been found desirable in order to secure a smoother operation and to protect the driving gears against the shocks of the engines, weighs 20 kg.

* By the "Zahnradfabrik Friedrichshafen."

ELEKTRON METAL

The Bureau of Construction and Repair has recently completed tests of Elektron Metal, manufactured by the Chemische Fabrik Griesheim Elektron. The report of the tests follows:

		Semi-hard	*Hard*
Thickness in inches		.035	.0335
Density in lbs. per cu. in		.06539	.06611
Weight in lbs. per cu. ft		113.0	114.2
Scleroscope hardness		22	27
Field point in lbs. per sq. in	*(1)	16,500	19,950
	*(2)	17,300	22,000
	**(3)	20,100	22,000
	**(4)	20,300	19,400
Tensile strength in lbs. per sq. in.	*(1)	33,100	44,200
	*(2)	36,150	46,400
	**(3)	37,950	51,600
	**(4)	37,950	51,200
Elongation in 2 in. in %	*(1)	10.0	2.0
	*(2)	23.0	3.0
	**(3)	14.0	7.5
	**(4)	12.0	7.0

* Specimens cut parallel to direction of rolling.
** Specimens cut perpendicular to direction of rolling.

The metal will resist the action of all alkalies but is attacked by acids and salt solutions and even by drinking and river water. Spar varnish is no protection but an enamel of bakelite is believed to give adequate protection. Elektron cannot be soldered, or even welded without difficulty. It can be furnished in the form in ingots, sheets, bars, tubes and structural shapes.

Elektron is excellent for castings and will not split or crack as does aluminum or other metals. A casting can even be bent double in some cases. It machines more easily than any other known metal.

The following alloys are produced, with magnesium as the chief constituent:

(1) "CM"—A special alloy specially adopted for electrical construction.

(2) "ZI"—Alloy with improved degree of hardness, principally used for purposes of mechanical fashioning.

(3) "AZM"—Alloy for such purposes as require a particularly high degree of hardness.

(4) "AZ"—The most popular alloy suitable for casting purposes, and which is particularly noted for its high degree of pliability, not being susceptible to cracking and splitting as is aluminum.

The melting point of Elektron is 630-650° C., about the same as aluminum.

Elektron will not catch fire unless heated above its melting point. It will not continue burning except when in the form of ribbon or shavings. Elektron burns with a quiet flame. No water should be used to put out an elektron fire, only sand.

Additional Physical Properties

From catalog of C. F. G. E.

Coefficient of expansion=.000,027.

"ZI" alloy (pressed)

E.L.	Ult. T.	M. of E.	Sheer	Brinell Hardness	Elong. %	Area Red. %
21-26,000	37-40,000	6,200,000	21,000	80	18-22	24

(*Concluded from page* 321)

10 A. M. The flight was resumed at 11:15 A. M. It was necessary to fly through the canyons, flying around rain, hail and snow storms until the formation landed in Eugene, Oregon, at 2:25 P. M. It began as our landing was made and continued to rain until nine A. M. the next day.

March 25th: A great deal of trouble was experienced in the take-off at Eugene, all three planes being mired in the mud several times. The planes finally took off at 11:30 A. M., dodging rainstorms until a landing was made in Portland at 12:50 P. M. The remainder of the day was spent in consultation at the District Forester's Office. Mr. G. H. Cecil, the District Forester, was in Olympia but had left instructions in his office to telephone him as soon as the detachment arrived.

March 26th: Mr. Cecil returned to Portland and the planning of our best method of operation was continued. It was decided to take Mr. Cecil on one flight over the devastated area and that the Forest Service would secure the services of Mr. Pendell, an observer of the Oregon Patrols of last year, to do the sketching.

At 10:50 A. M. all three planes took off for Camp Lewis. After flying about for about fifteen minutes, Staff Sergeant DeGarmo turned back to Portland with a leaky radiator. The two remaining planes landed at Camp Lewis at 12:15 P. M. The post was closed for the day and considerable difficulty was experienced in getting gasoline, etc., for the planes.

March 27th: Sunday was spent in preparing the planes for the mapping flights over the Olympic Peninsula.

March 28th: Two planes piloted by Capt. Lowell H. Smith and Lieut. Emil C. Kiel left Camp Lewis at 11:45 A. M. and with Mr. Cecil and Mr. Pendell, who was sketching, covered the entire devastated area, returning at 2:35 P. M. Staff Sergeant DeGarmo arrived from Portland after repairing his radiator at no government expense.

March 29th: Two aeroplanes flew with Captain Smith and Staff Sergeant DeGarmo as pilots, and Sgt. Lamar Thomas, photographer, and Mr. Pendell of the Forest Service, as passengers. Fifty-three photographs were taken and Mr. Pendell completed seventy per cent of the sketching. Flying time totalled seven hours and five minutes.

One dozen of the exposed plates were taken to a studio in Tacoma and developed by Sgt. Thomas. The results were fair.

March 30th: Three aeroplanes flew over the devastated area, piloted by Capt. Smith, Lieut. Kiel, and Sgt. DeGarmo, the passengers being Mr. Pendell, Master Sgt. Cornish, and Sgt. Thomas. Two hundred and eighty-one photographs were taken, most of them with the K-1 Mapping Camera. Mr. Pendell, with the assistance of Lieut. Kiel, completed all of the sketching. Flying time eight hours and forty minutes.

The ends from each roll of exposed films were rushed to a studio and developed with excellent results.

Mr. Cecil, the District Forester, having decided our work finished to his complete satisfaction, plans were made to start the return flight the next day. Excellent co-operation was received from the personnel at Camp Lewis.

March 31st: Return flight in formation started from Camp Lewis at 10:30 A. M. and arrived in Eugene with a flying time of 2 hours and 25 minutes. Remained over night in Eugene.

April 1st: Return flight resumed after a heavy fog had cleared at 10 A. M. A landing was made at Red Bluff for fuel and the formation landed at Mather Field and reported to the Commanding Officer at 4 P. M. Flying time 4 hours 35 minutes.

Summary of Reconnaissance

1. The general damage was caused by a south-west wind having an estimated speed of one hundred and eighty miles per hour. The devastated area spread over about one thousand square miles of very valuable timber land. As a rule the trees were laid flat to the ground over a spot of from five to a hundred acres, then the wind would be deflected, striking again a mile or two away. The timber on the south side of all the ridges was 100% destroyed.

2. Sketches and photographs have been turned over to the United States District Forester, whose headquarters are in Portland. All official figures relative to the actual damage should come from his office.

3. The Olympic Peninsula and the remainder of the area covered on the reconnaissance flight has very few inhabitants; it also has a small number of roads, or trails, and most of them were impassable, due to fallen trees. It is firmly believed that this flight of three aeroplanes has accomplished in three days actual work which would have required from two to three years, if undertaken by any other method. The Air Service has also saved the public from $125,000, the cost of a ground survey, to millions of dollars, or the amount that should be saved by Fire Prevention, due to aerial information furnished the United States Forest Service.

The cost of the flight is as follows:

Estimate

Aeroplane depreciation	$1000.50
One propeller	90.00
Gasoline, commercial, 466 gal. @ $.255	118.83
Oil, commercial, 148 qts. @ $.10	14.80
Gasoline, govt., 644 gal. @ $.355	215.74
Oil, 231 qts. @ $.1325	30.16
2 faucets	1.00
Grease, 3 lbs. @ $.50	1.50
Telegrams	3.25
Per Diem, etc., for personnel	192.92
Army pay for Personnel, 91st Squadron	328.30
Army pay for Personnel, 15th Photo Section	359.28
Photo Material	167.75
Total estimated cost	$2524.03

Flying Time

Pilots	To Camp Lewis, Wash.	From Camp Lewis, Wash.	Reconnaissance.	Total
Capt. L. H. Smith	470	420	550	1440
Lieut. E. C. Kiel	470	420	335	1225
Stf. Sgt. DeGarmo	490	420	525	1435
Total hrs.	23-50	21-0	23-30	68-20

MORE ABOUT PARACHUTES

IN our issue of May 16 we carried a story in which Major Bradley commented on the use of parachutes. We are now in receipt of a letter from Floyd Smith on the subject, as follows:

Because of the recent exposures in the Air Mail Service, the lack of properly safeguarding the pilot and the ever increasing scope of aeronautics, I feel that it is particularly important that the public at large and the flying world in particular, should be given authentic information on this subject.

Many of the world's premier flyers and aeronautical authorities whose courage and integrity have never been questioned, wear them and advocate the use by others of life packs for emergencies. The nations of Holland and Switzerland compel their use by legislation and the experience of those who have worn them show that they keep a man in his ship by the assurance of a safe escape as a final resort, instead of causing him to leap at the first excuse of trouble.

Certainly such aviation experts as Major Schroeder and Roland Rohlfs, along with many others holding responsible positions while using life packs, could not be accused of faintheartedness. Outside of exhibitions there is not one single instance on record where a pilot left his ship uselessly, although I personally know of some two hundred parachute descents made with the life pack adopted by the U. S. Air Service which illustrates that quite a number of life packs are in use.

A carefully kept record of deaths among aviators in the past two years, show that fully eighty percent, (the Tribune was in error when they quoted thirty percent) could have been saved were they equipped with life packs and accustomed to their use.

Postmaster General William H. Hays in an interview with a Chicago newspaperman on his last visit to Chicago, stated that it was his intention to make the Air Mail Service an auxilliary to the Army; that it was his opinion the greatest service this branch could perform was in the training of a pilot. Therefore, the trained pilot becomes the most important factor of the service and should be surrounded with safety appliances that have been proven practical.

Lieut. Shoemaker after making his record jump in this safety appliance stated that over 200 jumps had been made at Rantoul alone without a failure.

After diligent study and experiments with life packs, the aeronautical authorities of the Air Service Engineering Division and other branches, concluded that the competent air man would not desert his plane with a parachute, except under the most urgent and compelling circumstances, and one has only to make a parachute jump to reach the same conclusion.

In the previous mentioned article in Aerial Age, certain possibilites were mentoned under symbols "A", "B", and "C". These are the very causes of the majority of aerial fatalities that it is believed life packs will eliminate when their general use has been recognized.

NAVAL and MILITARY AERONAUTICS

Secretary Denby Impressed

During his recent visit to Haiti and Santo Domingo, Secretary of the Navy Denby was impressed with aviation activities on the island. If a Marine at an outpost becomes ill, he is conveyed to the Marine Hospital at Port-Au-Prince by plane, as it would take days for any vehicle to make 100 miles on the almost impassable trails across the mountains.

The Marine aviators on the island are making a complete survey of the island for the U. S. Coast and Geodetic Survey.

Davis-Douglas Company Gets Navy Order

Los Angeles.—Aeroplanes which will probably be used to guard the Pacific coast are being built in Southern California, it became known here recently, work having been started on a machine for the United States navy by the Davis-Douglas company of Los Angeles. This firm has a contract for the government which is said to call for delivery of several planes of a type believed to be the latest development in naval warfare.

Donald W. Douglas, president of the company, said recently no details could be given out, but if the first plane proves a success, a large order will follow, upon the completion of the present contract. The company has leased the Goodyear flying field and hangars and also a building of the factory group and as work progresses expects to employ a considerable force to supplement the present organization.

Air Station Day at Ocean Beach

Naval Air Station day at Ocean Beach, California, was well attended and the program was the source of much amusement. The Air Station boys carried away most of the prizes.

The winners and prizes in the various events were as follows:

Tug of war, Naval Air Station, box of Santa Fe cigar; three-legged race, C. M. Wren and W. L. Wren, tailored white uniform; shot put contest, Charles Brenner and B. L. Thrash, tennis shoes; pie-eating contest, T. D. Nabors, bathing suit; 100-yard dash, first, B. L. Thrash, cap, and second, Wm. Lockridge, tie; wheelbarrow race, C. M. and W. L. Wren; sack race, B. L. Thrash, gold cuff links; relay race, Miss Josephine Dilks, box of candy, and William Brooks, carton of cigarettes; boxing match, Red Uhlen, suit of blues, Sailor Ackerman, suit of whites; wrestling match, Billy Lockridge (winner) against Billy Brooks, tailor-made blouse.

Examination for Flight Test Observer

The United States Civil Service Commission announces an open competitive examination for flight test observer. A vacancy in the Engineering Division Air Service at Large, War Department, at $2,000 to $3,000 a year, and vacancies in positions requiring similar qualifications, at these or higher or lower salaries, will be filled from this examination, unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer, or promotion.

The entrance salary within the range stated will depend upon the qualifications of the appointee as shown in the examination and the duty to which assigned. After six months' satisfactory service appointees at annual compensation of $2,500 or less may be allowed the increase granted by Congress of $20 a month.

All citizens of the United States who meet the requirements, both men and women, may enter this examination; appointing officers, however, have the legal right to specify the sex desired in requesting certification of eligibles. For this position in the Air Servce at Large men are desired.

The duties of the appointee will be to observe and record, during actual flight, the readings of all instruments used on aircraft to indicate performance and meteorological conditions encountered; also the calibrating, regulating, and installing of such instruments and checking same against standards maintained for the purpose. The instruments involved are compass, altimeter, aerial thermometer, barograph, air-speed indicator, tachometer, ammeter, and various specially designed instruments that may be used to register detailed performance of engine, aircraft, or accessories.

Applicants should apply for Form 1312, stating title of examination desired, to the Civil Service Commission, Washington, D. C. Receipt of applications close July 5.

300 Officers Take "Exams"

Ensigns and lieutenants of the naval reserve force to the number of 300 are taking examinations this week for appointments in the regular Navy in the ranks they now hold. Three classes are convened: one for station officers, conststing of fifty; one for the fleet air officers, consisting of eighty, and one for officers of the destroyer force, consisting of one hundred and seventy. Each class is being presided over by a board of regular navy officers.

All examination papers will be sent to Washington. The reserve officers have been studying for several weeks and it is believed most of them will pass the examinations.

Fitting the R-38 for Atlantic Trip

London.—The R-38, the airship which the United States Navy has bought from the British Air Ministry, will take the air for her trial trip within the next fortnight. She is now almost complete at Short Brothers' works, at Cardington, New Bedford. As soon as the finishing touches have been put on her, British officials will try her out, and when satisfied will turn her over to her American crew. It is expected that she will make a trip across the Atlantic in the late summer.

The R-38 is the largest airship yet constructed in this country and is considerably bigger than the R-34, which made a memorable visit to New York. She is 695 feet long as against the R-34's 645 and 85 feet 4 inches in diameter as against the R-34's 78 feet 9 inches. This means that her gas capacity is 2,700,000 cubic feet instead of 2,000,000 and that she can lift 33 tons instead of the R-34's 24. Her cruising speed is 60 miles per hour, which was full speed for the R-34, and she can keep it up for 6,500 miles, while her predecessor would have been exhausted after 3,000. Moreover, she can rise 25,000 feet to the R-34's 13,800 feet.

This "ceiling," as it is termed technically, is the point on which her designers, of whom C. I. Campbell is the chief, lay special stress. For the R-38 is first and foremost a war vessel. She represents the lessons that the British air architects have drawn from the experience of the war and the observation of the German airships that were brought down during it.

The R-36 has been fitted for passenger accommodation and may with improvements be the type of airship with which the world will in a few years be familiar, but in the R-38 everything has been calculated so as to produce the most efficient air fighting machine. Consequently she is fitted for fourteen Lewis guns and one one-pounder automatic gun and for four bombs of 520 pounds and eight of 230 pounds. The one-pounder is installed in a sort of pit on her top, three feet deep, about over the control car toward her nose, and can fly horizontally and upward.

The Lewis guns are disposed in her engine cars and her stern, and there is also one which is placed underneath the gas bag, about a quarter of the way from her rudder, which will be operated by a gunner lying prone. It will fire to her rear and is intended to safeguard the "blind spot" which the British aeroplanes found, to their comfort, that every Zeppelin possessed.

The bombs are operated from the control cabin. In the bow is a sighting hatch through which the observer can tell what is immediately below the airship. Alongside it is a row of electric buttons, and all he has to do is to press one of these and can fire horizontally and upward.

The R-38 is driven by six Sunbeam Cossack engines of 350 horsepower each, in place of the five Maori 250-horsepower engines which drove the R-34. They are placed in six gondolas of sufficient size to enable the engineers to keep watch in them for hours at a time without discomfort, the central pair of engines are placed somewhat further out and higher than the fore and aft pair. All of them are directed from the control cabin toward the bow. This is slightly smaller than the R-34's and contains, besides a wireless room, quarters for the skipper.

The R-38 is the first service ship to carry regular beds for the crew. They will be accommodated in the bottom of the big bag, and bed frames have been erected over their platform, on which mattresses will be spread. They will not, however, be permitted to smoke, and they must be content with such food as they can heat by exhausts in the power gondolas. As the R-38 is expected to be out for only two or three days at a time, it is thought that the men can put up with such meagre comforts.

The trip across the Atlantic is expected to be very different from that of the R-34. That pioneer just managed to stagger to Long Island, but the designers declare that the R-38 carries plenty of margin for the journey, even in somewhat unfavorable conditions.

FOREIGN NEWS

Thames as Airport

Captain Guest, Secretary of State for Air, Lord Londonderry, Under-Secretary of State for Air, Colonel van Crombrugge, Belgian Director of Aeronautics, and other officials attending the Anglo-Franco-Belgian Civil Aviation Conference, witnessed the arrival on the Thames, May 11, of a Vickers-Viking amphibian machine which had flown from Paris carrying M. Eynac, French Under-Secretary for Air, and Sir Frederick Sykes, Controller-General of Civil Aviation.

The flight, which commenced at 10.20 a. m., was made in the rapid time of two hours, the machine landing above Westminster Bridge at 12.20 p. m.

It was the first occasion on which the Thames had been used as an air port for a machine from abroad, although the same aircraft had used the river recently as its port of departure on a flight to Paris.

Aviation in New Zealand

The New Zealand correspondent of Aerial Age writes:

Only one fatal accident occurred in that country for the eleven months ending March 5, 7921, in 152,096 miles of flying, the record of civilian aviation.

There are four companies operating in the country, two of which are subsidized by the government. The number of passengers carried in the eleven months was 5,884.

Rates on the Berlin-Brunswick-Dortmund Service

Fares per passenger (including conveyance by motor-car to and from the aerodrome, Berlin, and the Hapag office):—

Berlin-Dortmund (or *vice versa*), 500 mks. Berlin-Brunswick (or *vice versa*), 300 mks. Brunswick-Dortmund (or *vice versa*), 300 mks.

Each passenger is allowed 15 kg. luggage free of charge.

Excess 10 marks for every kg. or part of a kg., in so far as there is accommodation.

Air Mail Fees.—In addition to the usual fees for ordinary registered or express mails, the following fees (when possible in air mail stamps) must be paid:—Postcards, 20 pfennigs; letters up to 20 grammes, 20 pfennigs; 50 grammes, 80 pfennigs; 100 grammes, 160 pfennigs.

Japan Establishes Flying Harbor

It is reported in an issue of Shipping and Engineering that the Japanese Government contemplates the establishment of a great flying harbor at Urawa, Saitama Prefecture, in view of the coming expansion in aeronautics in Japan.

Van Berkel's Activities

The Maatchappij Van Berkel's Patent, the constructors of the very interesting seaplane which was illustrated in this journal recently, state that they have taken a licence for the manufacture in Holland of the Dornier tractor flying-boat, type Do Cs.II, which was illustrated in the same issue as was the Van Berkel's machine.

They state that this machine has excellent features, that owing to the narrow engine, the forward view of the pilot is at least as good as in the normal type of tractor machine, and that the lateral stability and the manœuvrability of the machine on the water is all that could be desired.

The passenger cabin gives ample room for five passengers (the German accounts give six as the capacity) and with this load, pilot and fuel for 3½ hours at full speed of five hours at cruising speed can be carried. The machine takes off quite happily in a reasonable following wind, or in a quite healthy side wind.

The machine is said to be a great improvement in the matter of water stability over the earlier two-engine Dornier passenger boat.

With regard to the sea monoplane of their own design, Van Berkel's Patent point out that an impression has arisen that this machine is a copy of a Brandenburg seaplane. It is to be pointed out that the Brandenburgs actually built in Holland were all biplanes, and that the Van Berkel's monoplane is a 'considerably larger and more powerful machine than any Brandenburg sea monoplane. It is in fact an entirely new design—carried out from the beginning by Van Berkel's Patent.

In the matter of the use of duralumin as a float material, it is stated that the duralumin used is a material which has been subjected to a special heat treatment. The process was developed in 1915 by the Düren Works in Germany, and this special duralumin has been found to be extremely satisfactory for sea work. So far as can be discovered no other firm has succeeded in producing an equally satisfactory material, and it is said that British tests of duralumin in salt water prove that the British alloy is entirely different in its qualities in resisting corrosion.

A Large Italian Flying Boat

Accordng to *La Propaganda Sportiva e Turistica*, of Turin, La Compagnia Bastianelli of Rome have built a large flying boat known as the P.R.B. (Pegna, Rossi, Bastianelli). The machine is an equal winged biplane, with three rows of interplane struts on each side, fitted with two wing nacelles each containing two engines, driving tandem airscrews.

The hull, of a maximum beam of 3.2 metres, is Vee bottomed and fitted with one step and apparently contains a roomy passenger cabin. The tail is a biplane, carried on a central fin, and fitted with one wide interplane strut on each side. Rudders, elevators, and ailerons are all balanced. The particulars available are as given in the specification below:—

Specification of the P.R.B. Flying-boat

Length over all ....16.5 m.	Seating and controls......100 kg.
Span ....30.0 m.	Tanks, pumps and piping..200 kg.
Height over all ....6.5 m.	Engines, airscrews and radiators ....1,450 kg.
Engine......4 Isotta-Fraschini V6	Sundries .... 50 kg.
Total area ....206 m.	Total weight empty......4,000 kg.
H.P ....277 at 1,300 r.p.m	Disposable load..........3,300 kg.
Weights:—	Loading ......25.7 kg. per sq. m.
Wing cellule ....1,000 kg.	Cruising speed .....160 km. p. h.
Hull ....1,000 kg.	Fuel capacity cruising.....10 hr.
Wing floats ....100 kg.	Climb...4,000 metres 30 m. 35 sec.
Tail ....100 kg.	

Fonck Sees Danger in German Planes

Rene Fonck, French aviation ace, and member of the Chamber of Deputies, has become alarmed over the rapid development of Germany's so-called "commercial" aeroplanes.

"We know," he said, "that there is really no difference between a military air machine and a camouflaged commercial aeroplane. It is only a question of whether passengers or bombs are carried. If we disarm Germany in the air and on land as thoroughly as England has disarmed her on the seas, there will be no danger, but to-day we are right in fearing the gravest results of this neglect on our part, for the Germans are able to turn out three or four thousand aeroplanes monthly of a type which is convertible for military purposes."

M. Fonck has gathered evidence of Germany's unprecedented activities in aviation since the armistice, particularly regarding the use of light alloys in couplings and motors and of air compressor appliances for the highest altitudes.

"German laboratories are working night and day," he continued. "We know that the Gottingen laboratories are the most perfect in the world and are being helped by important German capitalists. Not only is high resistance steel being used in the new aeroplanes in Germany, but also aluminum, the use of which is just beginning here. Moreover, a German invention known as elektron and being manufactured at Bitterfeld, is giving surprising results. Although we have been offered large supplies of elektron for our own use, we cannot accept it, as in the event of war it would be useless, as we have no knowledge of the process of its manufacture."

M. Fonck has reported to the Armament Commission regarding his personal investigation of Germany's air strength and resources, which has strengthened the belief here that Germany is rapidly reaching a point where she can produce aeroplanes capable of flying two hundred miles an hour and to turn them out at a rate which warrants the gravest fears regarding the future peace of Europe, or even the world.

The French Grand Prix

From Paris is it is reported that two Farmans have been entered for the second stage of the Grand Prix (May 20, 21 and 22). These are a twin-engined machine of the Goliath type, which will be piloted by d'Or and Bossoutrot, and an F.70, to be piloted by Bernard. The winner will be the competitor who has accomplished the fastest trip over the whole course. The machines are to carry 480 kilos, to represent passengers and 200 kilos. of freight.

New Canadian Ae.C. Activities

The Aero Club of Canada has just organized what they call "The Aeronautical Development Seetion." The work of this section will be to collect, record and distribute all kinds of information of aeronautical interest, and they will probably issue information through special bulletins. The Club, therefore, would greatly appreciate copies of catalogues, aeronautical periodicals, copies of any proceedings of aeronautical societies or organizations, in fact anything in aeronautics.

They also gladly offer their services to manufacturers of aircraft corresponding with them.

The Survey of the River Congo

An aerial photographic survey of the River Congo is to be made and it is expected that complete charts based on the photographs taken will be issued within the next three years. The former methods of survey would take at least ten years to do the same work.

New Aero Stamps

A new series of aero stamps was issued for the free city of Danzig at the beginning of this month. They have been designed and printed locally, the *Daily Telegraph* states, at the works of Julius Sauer, where the recent commemorative stamps of the "ship" type were produced. There are five values in two designs, each of which shows an aeroplane in flight over the city, the skyline of which is shown in silhouette. The 40 pfennig green, 60 pfennig dark purple, 1 mark crimson, and 2 marks brown are in the small size of the normal German stamps, and the 5 marks blue is of large oblong shape. The stamps in the small size are perforated 14, and the large 5 marks in zigzag, rouletted 13½. These novelties supersede the three German-Danzig stamps overprinted with winged posthorn and biplane devices which were issued last year. Other new aero stamps which may be expected at an early date include a Spanish set in a new design by Senor Maura. At present on the Barcelona-Alicante-Malaga route ordinary Spanish stamps overprinted "Correo Aereo" are used. The new stamps will also be used on the new routes Seville-El Araish, Barcelona-Majorca, and Malaga-Melilla.

An air mail is being established in the Portuguese colony of Macao, and it is very probable that specially overprinted stamps will be used. A small quantity of the French military occupation stamps of Syria has been overprinted "Poste par avion" in violet, for use in connection with an aerial mail between Aleppo and Alexandretta. The values and quantities so overprinted are:

1 piastre on 5 centimes green (1,000).
5 piastres on 15 centimes olive-green (500).
10 piastres on 40 centimes red and blue (500).

Presentation to M. Flandin

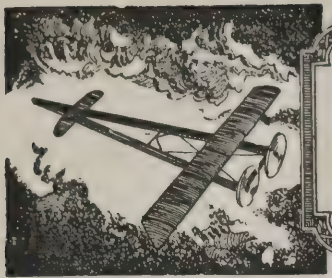
At a monthly gathering of the Aero Club of France, last week, a gold medal was presented to M. Flandin, former Under-Secretary of State for Aeronautics, in recognition of his services in the development of French Aviation.

A Heavy Oil Engine for Aviation

The "Ferrotaie" Co., Ltd., of Turin, is at the present time manufacturing some small heavy oil engines. They are to be used for naval, agricultural and industrial purposes. Their main features are the followinig: Bore, mm. 100; stroke, mm. 120; maximum power, 4½ h.p. at 1,200 revolutions per minute; oil consumption, about 345 gr. per h.p. hour. The inventor, Eng. Bagnulo, proposes to use such engines for aviation. Acting on this idea he has designed a 600 h.p. heavy oil fast engine to be fitted on aeroplanes.

The first example is now being manufactured by the above-mentioned company and will soon be put on trial.

The great interest that this engine will have for civil aviation is due to the fact that it diminishes greatly the cost per h.p. hour.



ELEMENTARY AERONAUTICS *and* MODEL NOTES

IN a general way it can be considered that the pitch of a propeller will depend upon the speed the model is capable of making, and the diameter is determined by the amount of power delivered by the engine. When the model's speed is known, the practice is to supply it with a propeller possessing a pitch which will advance (theoretically, in a solid medium) at a rate of from 10 to 20 percent greater than the actual advance of the model. This allows for the "slippage" due to the rarefied nature of the air. Propellers with carefully measured pitch, with smooth, accurate outlines and which have perfectly balanced blades, have a slippage loss of only about 10 percent.

Every model has a fairly definite amount of wing lift and a certain amount of air resistance. These two factors result in a model having a definite forward speed which, without altering the angle of the wings, will neither be increased nor lessened, no matter whether power is added or taken away. If power were to be added, the actual advance forward would be the same and the model would climb. If power were lessened, the actual advance forward would continue the same, and the model would dive, for gravity would give the model the necessary forward speed until it reached the ground.

The most efficient speed for a model is the rate of speed it attains when in a perfect glide. Once this speed has been determined, the task of supplying it with a propeller of suitable pitch is easier. It must be remembered that during a test glide, all weights must be similar in distribution and magnitude to those to be applied on the model when in flying trim.

When the rate and time of glide have shown the model's speed, the propeller designed to fly it should have a pitch equal to that advance in a similar period of time, plus the percentage necessitated by slippage. To supply a propeller with a less pitch than required would prevent the model from flying, while to give the propeller too great a pitch would cause a higher percentage of inefficiency.

Model builders who give special consideration to these points have a great advantage over those whose propellers are designed from the standpoint of good appearance rather than from known aerodynamical limitations.

Shrinking Fabric on Wings

On some of the light-weight models it is desirable to eliminate the use of water-proof dope on the wings. The difficulty of drawing the paper covering smoothly over the entire wing frame can be overcome by dipping the finished wing in water and drawing it out again instantly.

The paper or silk covering should be attached to the frame rather smoothly and evenly, but not tightly. When the fabric has been securely attached and the glue has completely dried, plunge the entire wing into a shallow vessel of water but withdraw it immediately or too much shrinking will occur. As the wing dries out it will be seen to tighten up considerably and if the wng has not been permitted to soak up too much water in the immersing process, it will leave the fabric tight and smooth.

Another method of tightening up the wing fabric is to hold the undoped wing over the steam from a kettle. The wing must be moved back and forth across the spout of the kettle quite rapidly to prevent the wing from becoming distorted.

If a finish is desired on the wings, a coat of varnish or shellac can be applied after shrinking, thereby adding to the appearance and durability as well as helping to keep out moisture.

Hydrovane Models

Good flights can be made from the water with models equipped with small "vanes" or inclined plane surfaces which replace the ordinary pontoon floats. With models so equipped, it is necessary to start the initial run on a smooth board submerged in the water.

As the vanes proceed through the water they lift the model clear of the surface in a very short run—usually much shorter than required by the ordinary pontoon model to get off. Vanes have very little resistance to the air and water as compared with pontoons and there is also a good saving in weight in favor of the vanes.

In returning to the surface again when the power is spent, a well balanced model will skim over the surface until its momentum is lost and then gradually sink lower into the water until the wings rest on the surface. A model properly waterproofed will suffer no damage by such landings. The speed obtainable from models fitted with hydrovanes is another reason why they appeal to those who wish to build a model somewhat different from the conventional types more widely copied.

Loening Racing Model Built by Aerial Age Reader

An exceptionally neat flying model has been built by Mr. R. Wilson Wilmer of Brooklyn, N. Y., who followed the outlines of the Loening Special Racing Monoplane drawings which were published in AERIAL AGE on December 20, 1920. The model, which is made five times the size of the Aerial Age drawing, measures 30 inches from wing tip to wing tip, has an overall length of 23 inches and weighs slightly less than $9\frac{1}{2}$ ounces. As it has been the builder's endeavor to make the model as near an exact duplicate of the full sized Loening Special as possible, no attempt has been made to keep down the weight by neglecting minor details.

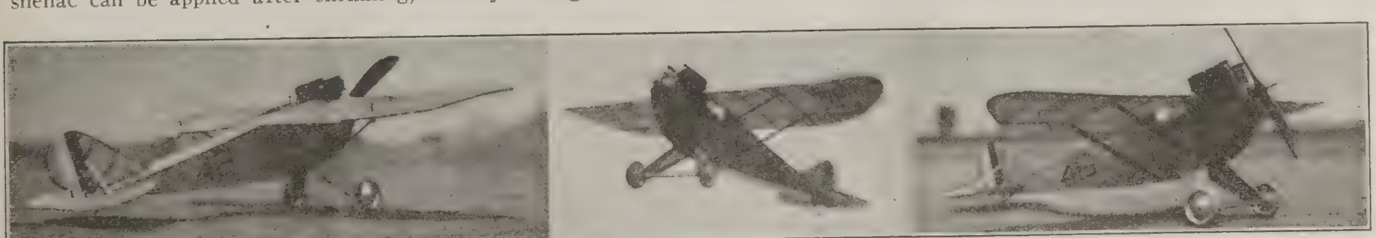
In only one instance was any departure made from the drawings published; that was in making the landing chassis. The landing gear struts were purposely made $1\frac{7}{8}$ inches longer than called for, to allow sufficient clearance for an eleven-inch flying propeller. This extra length increased the distance between the propeller hub and the ground by $1\frac{1}{4}$ inches.

The wings, which are detachable, are made up of $\frac{1}{8}''$ square spars, with $3/32''$ reed for leading and trailing edges. Ribs are of $1/16''$ balsa and the U. S. A. No. 1 wing curve was used. $\frac{1}{8}''$ square white pine has been employed throughout for longerons, internal bracing, etc.

The dummy motor is built to scale and is cut out of balsa. This wood has also been used for covering the nose of the machine.

The ailerons and elevator are operated by a control stick, while the rudder is controlled by a rudder-bar. The stabilizer is adjustable and is operated from the cock-pit. Landing gear and tail skid are both equipped with rubber shock absorbers. Openings are cut in either side of the body for the pilot's vision, and, as in the real machine, are provided with adjustable wind shields.

Bamboo paper has been used to cover the wings, empennage and fuselage. Two coats of shellac were given after doping. The propeller is made of cedar, is $8\frac{1}{2}''$ long and is copied after the one used on the original machine. The motive power is supplied by about 35 feet of $\frac{1}{8}''$ flat rubber.



A flying model of the Loening special racing monoplane, built by R. Wilson Wilmer

Short History of War

(*From American Legion Weekly*)

"Now cough."
"Sign here."
"When do we eat?"
"Haven't any 8's. Take a pair of 10's."
"There's a soldier in the grass."
"You're in the army now."
"Treat 'em rough."
"Read 'em and weep."
"All we do is sign the payroll."
"It's a great life if you don't weaken."
"The first seven years are the hardest."
"Where do we go from here?"
"You can't stand there, soldier."
"Oo-la-la."
"Lafayette, we are here!"
"Let's go."
"Any seconds on goldfish?"
"Madelon. Madelon, Madelon."
"Encore the vin rouge, see voo play."
"Toot sweet, monsieur."
"Is your right arm paralyzed?"
"Mother, take down your service flag, your son's in the S. O. S."
"Bon soir, ma cherie, ou allez you?"
"Paint it with iodine and mark him duty."
"Son fairy Ann."
"Heaven, Hell or Hoboken by Christmas."
"Fini la guerre."
"In the army, the army, the democratic army."
"So this is Paris!"
"Hinky-dinky, parlez vou."
"If I ever get out of this man's army—"
"Who won the war?"
"There's a long, long trail a-winding."
"When do we go home?"
"We've paid our debt to Lafayette—who the heck do we owe now?"
"When the cruel war is over."
"Say 'ah-h-h' and sign here."
"Let's eat."

TECHNICAL TERMS ILLUSTRATED.

A Nose Dive.—(With apologies to "Veritas.")

Adam's downfall was due to an apple, but most any soldier's downfall can be traced to a peach.

Well Known Querries

(Supplementary to Monte Rolfe)

Mister, are you the man that flies in that 'ere airship?
Well, ain't you afraid?
Don't it make you giddy up there? Ain't it cold?
If your engine stops you fall, don't you?
Ain't it got gears jus' like an automobile? Can it go backwards?
Can you look down from up there?
Did you see me when you flew into town? I was down by Two-Fork Creek fishin'.
You come back from France in that flying machine, didn't you?
Why do you run on the ground before you go up?
Yes, sir; I can go if Bill Jones kin. (After trip)—H-H-Hey, F-F-Folks, T-That's the greatest thing I ever experience. W-Wasn't scared a-tall.
CAUTION—Never try to land in the place the local wiseacre marks out. You couldn't drive a wagon in it, much less an aeroplane.

Craig Hurst.

"Loose Washers"

A Chink by the name of Ching Ling,
Fell off an air-taxi, bing-bing,
The pilot turned his head,
And to the people said:
"The ship's lost a 'washer', ding ding."

Ex-Flier.

Humeronautics

The wild cat's in the manger,
Her whelps around her curl;
The dogs are in the dog-house,
The buoy's without a girl.
They roll Bull in the bull ring,
The anchor's fished and caught,
The bugler's sounded school call—
The ship will soon be taut.

—The Log.

A Man

Edgar A. Guest

A man doesn't whine at his losses.
A man doesn't whimper and fret,
Or rail at the weight of his crosses
And ask life to rear him a pet.
A man doesn't grudingly labor
Or look upon toil as a blight;
A man doesn't sneer at his neighbor
Or sneak from a cause that is right.

A man doesn't sulk when another
Succeeds where his efforts have failed;
Doesn't keep all his praise for the brother
Whose praise is publicly hailed;
And pass by the weak and the humble
As though they were not of his clay;
A man doesn't ceaselessly grumble
When things are not going his way.

A man looks on woman as tender
And gentle, and stands at her side
At all times to guard and defend her,
And never to scorn and deride.
A man looks on life as a mission,
To serve, just so far as he can;
A man holds his noblest ambition
On earth is to live as a man.

—"A Heap o' Livin'."

Engineering

AERIAL AGE WEEKLY

VOL. 13, No. 15 JUNE 20, 1921 10 CENTS A COPY

Photo by Fairchild Aerial Camera Corp

Airscape of the American Art Museum, New York City

The Press on the Menoher-Mitchell Controversy

PUBLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
Subscriptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

AERIAL AGE WEEKLY

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIII NEW YORK, JUNE 20, 1921 NO. 15

THE PRESS ON THE MENOHER-MITCHELL CONTROVERSY

SO far as one can judge from the sidelines the struggle between General Menoher and General Mitchell (if the move of a superior to oust a subordinate can be called a struggle) is between old ways and new.

General Menoher came to the air service at the conclusion of the war with a good reputation, but no training in aeronautics. General Mitchell became his assistant, and he brought to the army air service not only a great interest in flying, but considerable experience as a pilot and the fruits of study as an air strategist. General Mitchell has spoken up loudly in favor of a united air service. He believes implicitly in the future of military flying. During the last year, in fact, he is the only man in the army or navy who has made a sufficiently noisy protest against the stupid naval programme of 1916 to make congress realize that battleships and destroyers may be useless in a few years. If General Menoher genuinely believes in the department he heads he has not in a time of crisis made his opinions notable. One suspects, frankly, that he is the typical West Pointer, coming to a new job too late in life to give it what it deserves. One suspects that the vigor manifested by the army air service during the last several years may be largely attributed to the courage, energy and convictions of General Mitchell. Well, General Menoher asks now for the removal of General Mitchell. Those who are interested in flying see clearly that he asks for the elimination from responsible position in the air service of the man who has been most active for the development of that service.

General Menoher, whether he knows it or not, acts in this matter for the army and navy conservatives. The older officers in both our services understand rifles, siege guns, and battleships. They do not understand aeroplanes, poison gases, aerial torpedoes. They have refused to see that what they understand threatens to become obsolete in a few years, while what they do not understand threatens to become all important. They have successfully applied to congress for an enormous naval programme. They have kept battleships and guns in the foreground, aircraft, submarines, radio, and gas in the background. One wishes both could be forgotten, but since war is still a possibility one wonders why the developing weapon is neglected for the developed one. General Mitchell has voiced this wonder in a protest. He has not thus far wrecked the conservative programme, and the conservatives seem to have stacked the cards against him in the aircraft versus battleship test. Still he is an active, opposing influence, and he has disturbed them. If he were out of office their work would go more smoothly. General Menoher is serving them in urging General Mitchell's removal, whether he acts for himself or—consciously or unconsciously—as the member of a military group. Secretary Weeks must face this fact when he makes a decision upon General Menoher's request.—[*Editorial in N. Y. Globe.*]

THE friction in the Army Air Service interests the whole country. The chief of the service, Major-General Menoher, has asked the Secretary of War to transfer the Assistant Chief, Brigadier General Mitchell. General Menoher disapproves of General Mitchell's somewhat exuberant insistence that complete revolution in the art of war is at hand: that aircraft can sink the most powerful fleet extant. It is not alleged that General Menoher repudiates the theory but that he does not like General Mitchell's way of advocating it.

"There is no question," says Secretary Weeks of the War Department, "but that General Mitchell has annoyed the navy." What if he has? The navy should not be annoyed by Mitchell's declarations. It should be vastly interested. If General Mitchell and his bombers can sink battleships of modern type and escape it means that the navy must have a new programme, or at least that the entire defensive methods of the United States must be changed.

If the Mitchell way is practicable then an adequate air service would make our coasts immune from attack. Our navy could be concentrated on the offensive, yet would have to be improved along the lines of greater resistance to aerial assault. Why should the thought of this annoy the navy?

In the mind of the public the personal fortunes of Menoher and Mitchell are negligible. The matter of national defence is not negligible. But the public is interested in Mitchell's proposal of a great test of his idea. It wants to know. It believes that it may be possible to save some of the millions that are poured yearly into dreadnoughts. William Mitchell has been the generally accepted leader of the new idea. He may lack tact, but he has courage and enthusiasm.

Whatever the Secretary of War does about the request to transfer General Mitchell he should not shelve Mitchell's challenge to the navy for a trial of the bombing plane's strength against the battleship. Let the Secretary iron out the personal and official differences of his men, if he will, but let him not flatten out a good idea. The best way would be to let General Mitchell try his great experiment. If it succeeds he will be justified for all his exuberance. If it fails he will be sadder than any transfer could make him.

There is such a thing as too much Alphonse and Gaston courtesy in and between the army and the navy. They are, from the Secretaries, Generals and Admirals down to the lowest rank of the enlisted, servants of the nation and nothing

(*Concluded on page* 359)

THE NEWS OF THE WEEK

New High Lift Wing

A new aeroplane wing has been invented which will increase the carrying capacity of a machine five times, add to its speed and permit landing in a comparatively small area, G. M. Williams, general manager of the Dayton Wright Company, announced June 12.

These three merits are what aeronautical engineers everywhere have been working for. Although he would not describe the construction of the wing, Mr. Williams said concerning it:

"The wing will increase the speed of an ordinary type of bombing or commercial aeroplane to 125 to 150 miles an hour, and its load of explosives or merchandise from 450 to 2,500 pounds, in addition to fuel for a thousand mile flight.

"It enables the commercial pilot to load his machine to the maximum and vastly increase his speed on routes where ordinary landing fields are available, or on new routes over emergency and small fields he can so reduce his landing speed as to alight in a comparatively small area. This makes possible the establishment of terminal facilities only a few hundred feet square in the heart of large cities."

Both army and navy airmen have been examining the new wing for purposes of national defence. Representatives of foreign governments also have visited Dayton to witness wind tunnel tests, which have been going on for several months.

Aviator Explores the Grand Canyon

Williams, Ariz.—Lieutenant Alexander Pearson, army flier, flew into the Grand Canyon June 11, landed and took off again during an exploration of the canyon, to study its air currents for the Department of the Interior and to locate possible landing fields.

"In spite of the fact that the upper part of the Grand Canyon is thirteen miles from rim to rim and the lower gorge is eight miles wide," said Pearson in describing his experiences, "I felt cramped for room when I was descending into the chasm. I seemed every moment to be flying right slap into some cliff."

Pearson also flew north of the canyon seeking a landing field. He found it in what is known as Big Park, the only clear space among the great pine forests that clothe the Kaibab Plateau. Big Park is at an altitude of more than 9,000 feet.

Cleveland Aviation Club Active

The Cleveland Aviation Country Club organized and carried through a program of aeronautical events on Decoration Day which created substantial interest in the mid-western city. Capt. Edwin Musick piloted the Santa Maria from Detroit and gave some sixty passengers their baptismal flight during the day. A number of locally owned machines were also in evidence.

Adirondacks by Aeroplane

From New York City to the resorts of the glorious Adirondack country will be a matter of minutes instead of hours when the aero vacation express system goes into effect. Just when this will be has not been announced, but prominent hotel men here predict that it must soon follow the developments for aeroplane flights throughout the summer.

Very soon the aeroplane "busses," each equipped with 400 horsepower Liberty motors, will be skimming through the Adirondack ozone and passengers will be informed either that "Mount Marcy is dead ahead," that "we are now 1,500 feet above Paul Smith's and the St. Regis Chain of Lakes," or perchance that "the stretch of blue at the right is Lake Champlain; the one at the left, the St. Lawrence."

The Adirondack Air Service, Inc., which will operate a fleet of six passenger planes during the summer and early autumn, will have its headquarters at the village of Ticonderoga, with booking offices at each of the principal Adirondack hotels, while from Lake Placid, as a base, another fleet of seven seaplanes, under the direc- will make daily scheduled passenger flights between Lake Placid, Saranac Lake village, Paul Smith's, on the St. Regis Chain of Lakes; Saranac Inn, on the Upper Saranac, and Loon Lake. Also there will be an aviation school in which members of the younger set will receive instruction in the art of flying.

Air Mail Examinations

The United States Civil Service Commission announces open competitive examinations for Field Manager, $2,000 or over a year, and Foreman Mechanic, $1,800 to $2,000 a year. Receipt of applications close July 12, 1921.

Goes 150 Miles by Air and Saves a Patient

Norfolk, Va.—A 150-mile flight to save the life of a coast guardsman overcome by gasoline fumes was made May 26 by a seaplane from the naval base here. The plane, bearing Lieut. C. L. Haines, a surgeon, was despatched on receipt of a telephone message from Manteo saying that the life of W. B. Midgett was in danger. The only physician living between Virginia Beach and Cape Hatteras was not available and the Coast Guard authorities asked for help from the naval base. Treatment was given the injured man, and he is expected to be on his feet within ten days.

Hartford Municipal Aviation Field where the Aerial Meet was held June 11

Hartford Aerial Meet

With 30,000 spectators present, the aerial meet at Hartford, Conn., marking the opening of Brainard Field, which is part of the Hartford Municipal Air Port, took place on Saturday, June 11.

The feature of the day was the race from Hartford to Springfield and return for the Charles K. Hamilton Memorial Trophy, named in honor of the pioneer in aviation who, in June, 1910, won the $10,000 prize offered by the New York *Times* for the New York to Philadelphia flight, and who, eleven years ago, carried on extensive experiments in bombing and commercial flying.

Lieutenant R. C. Moffat, representing the First Corps Area, Army Air Service, was the winner of the Hartford-Springfield race, making the flight in a DeHaviland in 25 minutes and 35 seconds, for the 48-mile course, or an average of nearly 120 miles an hour.

The race was on a handicap basis, owing to the widely varied speed of the entries. John M. Miller, flying a Curtiss Oriole, made the round trip in 34 minutes 5 seconds, or 31 minutes 41 seconds corrected time. The corrected time for Lieutenant Moffat was fractionally over 30 minutes. Charles ("Casey") Jones made the trip in 33 minutes 1 second actual time, also flying an Oriole. E. P. Lott, of Bridgeport, Conn., finished fourth.

The contest for the Charles K. Hamilton Trophy, which was donated to the Hartford Municipal Aviation Commission by Seymour Wemyss Smith, writer, of Hartford, took place in the presence of father, uncle and sister-in-law of the once famous flier, who died in 1914 and who is buried within a few miles of Brainard Field. Lieutenant Moffat accepted the trophy in behalf of the Army Air Service and it will be displayed at the Boston headquarters of Major Leonard H. Drennan, commanding the First Area, Air Service.

In a seaplane race to Middletown, Conn., and return, a distance of 28 miles along the Connecticut River, Lieutenant Richardson, U. S. Navy, was the winner by four minutes over the entry winning second place, an H. S. boat piloted by Harry P. Lewis, of Springfield, the handicap proving the deciding factor as Mr. Lewis finished in 22 minutes and 50 seconds actual flying time, 52 seconds better than the naval plane. The boat carried a moving picture photographer and camera man as passengers on the flight.

"Casey" Jones made a perfect score in a dummy bomb dropping contest, scoring five hits out of five tries. Lieutenant Stuart Chadwick, former army flier, who has for several months been flying near Hartford, was a close second. A number of other pilots gave good account of themselves.

E. P. Lott won the Aero Club of Hartford's trophy for landing accuracy, a handsome silver loving cup, and also won in the aerial acrobatics contest. Lieutenant Chadwick and R. M. Haynes, of Lynn, Mass., contributed the most spectacular flying of the day.

Hiram Percy Maxim is president of the Hartford Aviation Commission. The meet was supervised by Lieutenant Samuel P. Mills, air service, and James B. Slimmon, former army captain and member of the Hartford commission. Judges were: Major Leonard H. Drennan, Major Augustus Post, secretary Aero Club of America, and Major William J. Malone, Connecticut state aviation commissioner. Alderman John M. Holcombe, Jr., of Hartford, former army captain and for a time in the air service, acted as observer and starter. Captain Meredith, of the First Corps Area, Air Service, also acted as a meet official and Lieutenants Fasteneau and L. D. Warrender from Framingham were also present. Major Watson flew from Mineola during the afternoon and remained during the meet.

Major Drennan has said that he considers the Hartford Municipal Air Port the best flying field in New England. Brainard Field, named after the present mayor of Hartford, is a tract of 100 acres and it has been graded and equipped by a city appropriation of the Hartford Board of Aldermen. There is a club house, in addition to a gasoline and supply station.

The field is located on the bank of the Connecticut river. It is large enough to accommodate the largest planes and, aside from the field itself, there is an area of 500 yards in each direction from the field, suitable for a safe landing. There is an underground telephone connection. The field is within a few hundred yards of trolley lines but fliers visiting the city should phone Mr. Maxim, C. M. Knox or Captain Slimmon of the aviation commission who will provide auto accommodation. Six moorings are provided for seaplanes. Standard field markers and wind directors are in place.

UNITED STATES POST OFFICE DEPARTMENT—AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, April 1921

DIVISION	Gasoline	Grease and Oil	Repairs and Accessories	Miscellaneous	Motorcycles, Trucks	Rent, Light, Fuel, Power, Telephone, and Water	Office Force and Watchmen	Warehouse	Pilots	Mechanics and Helpers	Radio	Departmental Overhead Charge	TOTAL	SERVICE AND UNIT COST				
														Gallons of Gasoline	Total Time Run	Total Miles Run	Cost per Hour	Cost per Mile
New York-Washington...	$1,887.38	$387.45	$1,628.75	$861.90	$970.87	$587.19	$1,370.00	$256.66	$1,079.94	$1,615.21	$590.06	$198.10	$11,433.51	5,581	hr. min. 170 34	14,842	$65.08	$0.77
St. Louis-Twin Cities...	3,641.40	1,103.31	6,867.24	2,872.61	1,052.75	465.57	2,358.26	769.99	3,348.21	3,363.47	1,770.20	594.30	28,207.31	10,549	375 58	31,308	75.00	.90
New York-Cleveland.....	3,049.77	725.07	6,276.67	2,083.87	869.19	470.71	1,830.73	513.33	2,325.54	3,305.66	1,180.13	396.20	23,026.87	8,381	294 46	25,246	78.60	.91
Cleveland-Chicago......	2,768.57	696.72	886.07	1,563.95	727.45	228.18	1,487.41	384.99	2,016.09	1,737.63	885.10	297.15	13,679.31	7,880	232 02	19,605	58.94	.70
Chicago-Omaha.......	3,305.52	1,051.90	671.82	1,334.58	563.91	162.36	1,410.82	513.33	2,198.96	1,707.79	1,180.13	396.20	14,497.32	9,317	288 34	25,815	50.23	.56
Omaha-Salt Lake.....	4,967.96	1,143.77	5,518.57	2,341.61	1,191.99	407.20	1,775.24	1,069.43	4,486.72	3,610.01	2,458.60	825.40	29,796.50	15,393	438 54	36,789	67.86	.81
Salt Lake-San Francisco.	3,336.01	446.53	9,472.20	1,771.21	1,081.69	237.91	2,021.83	769.99	2,510.03	3,237.94	1,770.19	594.29	27,249.82	9,753	374 22	33,345	72.78	.82
Totals and Averages......	$22,956.61	$5,554.75	$31,321.32	$12,829.73	$6,487.85	$2,559.12	$12,254.29	$4,277.72	$17,965.49	$18,577.71	$9,834.41	$3,301.64	$147,890.64	66,854	2,175 04	186,950	$67.98	$0.79

New York-Cleveland Division:
Loss on unrepairable crashes............ $6,000.00
Cleveland-Omaha Division:
Loss on unrepairable crashes............ 10,000.00

Total Cost—Crashes........... $16,000.00
Total Operating Charges.................... 147,890.64

Grand Total.................. $163,890.64

Overhead consists of:
Office force and watchmen; motorcycles and trucks; rent, light, fuel, power, telephone and water; departmental overhead, and radio.
Flying consists of:
Gas, grease and oil, and pilots.
Maintenance consists of:
Miscellaneous; mechanics and helpers; repairs and accessories, and warehouse.

COST PER MILE

Division	Overhead	Flying	Maintenance
New York-Washington........	$0.25	$0.23	$0.29
St. Louis-Twin Cities..........	.20	.26	.44
New York-Cleveland..........	.19	.24	.48
Cleveland-Chicago............	.19	.28	.23
Chicago-Omaha...............	.14	.26	.16
Omaha-Salt Lake.............	.18	.29	.34
Salt Lake-San Francisco........	.17	.19	.46
Entire Service................	.18	.25	.36

E. H. SHAUGHNESSY, Second Assistant Postmaster General.

The AIRCRAFT TRADE REVIEW

Chicago Sees Aeronautic Opportunity

A plea to the business men of Chicago to encourage the aeroplane manufacturing industry of the country and make Chicago to aviation what Detroit is to the automobile industry was voiced by Charles S. Rieman, president of the Elgin Motor Car Corporation, and chairman of the automotive section of the Pageant of Progress exposition, at a luncheon-conference of Pageant officials last week on the Municipal Pier, where the big exposition is to be held July 30 to August 14.

"The aircraft industry is coming along faster than the automobile industry in its early days," said Mr. Rieman. "It is the last, the greatest, the ultimate means of transportation, and I believe Chicago can become the center of the industry. If Chicago business men go after this business in a broad, far-visioned way, Chicago can become to the aircraft industry what Detroit is to the automobile industry.

"Detroit got the automobile industry in its early days by showing a little more vision than other cities, and today she draws tribute from every village in the civilized world. There are aeroplane men in many cities of America today standing just where Haynes, Ford, Duryea, Winton, Stearns and other pioneers did in the early days of the automobile industry. They need money, and help, and if we give it to them now, we will see the day when every little village in the world will pay us tribute."

Mr. Rieman and Ralph Diggins are working on the aeroplane phase of the automotive section at the exposition, and within a week it is expected that they will be able to announce the plans which will make the aviation part of the Pageant one that will draw thousands of people to Chicago to witness that feature alone.

Census of Manufactures

In a comparative summary of the census of manufactures of the United States in 1919 and 1914 issued by the Department of Commerce the following statistics relating to the manufacture of aeroplanes, seaplanes, airships and parts: Number of manufacturing concerns in 1914,16; in 1919, 31; Value of products 1914, $790,000 and in 1919, $14,373,000.

Westchester Aerial Dispatch Organized

The Westchester Aerial Dispatch has been organized in White Plains, New York, and will operate flying boats from the flying station at Beach Hill, Rye, N. Y., carrying passengers and doing general advertising work. Cliff Webster is pilot for the company.

The officers of the company are F. E. Weeks, Vice-Pres.; Geo. G. Werner, Vice-Pres.; Theo. Fremd, Vice-Pres.; Wm. A. Dickens, Mgr., Louis Eidelstein, Traffic Mgr.

Personal Pars

Frank H. Wheeler, president of the Wheeler-Schebler Carbureter Corp., died at his home in Indianapolis on May 27.

Lambert With North American Aerial Transport

Capt. W. C. Lambert, Ace, has gone to Washington as pilot for the North American Aerial Transportation Company. Captain Lambert is officially credited with twelve and unofficially with many more German planes, and has been decorated with the Distinguished Flying Cross (British). Prior to American entry into the World War, Captain Lambert, whose home is in Ohio, joined the Royal Air Force in Canada, and was with this organization until the end of the war, at which time his transfer as a major to the American air service was in process. These commercial flights are made from the Washington Airport at the south end of the Highway Bridge, from where passengers are carried on an aeroplane sightseeing tour over Washington. It is hoped that the first airship for the North American lines will be put into operation about July 1.

Aeroplane Tire Development

At the request of the War Department the tire industry of this country, through the Tire and Rim Association, has attacked the problem of straightside tires for aeroplanes. The reason is to be found in the unsatisfactory service rendered during the War by aeroplane tires of the Palmer clincher bead type and in the recognized superiority of the straightside type of bead in other fields.

The program provides for the following sizes—28 x 4, 30 x 5, 32 x 6, 34 x 7, 36 x 8, 44 x 10 and 48 x 12. Loads and inflation pressures are based on a tire deflection of 20% and range from 1,000 pounds and 50 pounds per square inch in the 28 x 4 to 9,000 pounds and 70 pounds per square inch in the 48 x 12. All rims except the 44 x 10 and 48 x 12 are to be of a one piece, channelled center type without detachable side flange. The 10 and 12 inch rims will be of the conventional automobile type with detachable side flange.

The Tire and Rim Association has apportioned the experimental work among the tire manufacturers so that each of the sizes may be developed simultaneously. The 36 x 8 and 44 x 10 tires have already been subjected to laboratory and service tests at McCook Field by officers and engineers of the Air Service. Their performance was entirely satisfactory and quite free from the objectionable features and defects of the heretofore standard tire.

It is a hopeful sign that the largest foreign tire standards body is showing great interest in this work.

RÉSUMÉ OF PROGRESS OF AERONAUTIC MATTERS IN CONGRESS

In this bulletin, prepared by the Manufacturers' Aircraft Association, there is given a recapitulation of all legislation and other matters affecting aviation, which have been before the present Congress (67th Congress—1st Session) since it convened April 11, 1921, to June 3rd. Hereafter weekly bulletins will be issued. In order to use these bulletins it will be necessary to retain the complete file as no additional mention will be made of a subject once covered, until there is a change to report. A file of these bills is kept in the Association Library for use of members.

Following is a key to the committees: I. and F. C., Interstate and Foreign Commerce; M. A., Military Affairs; N. A., Naval Affairs; A., Appropriations; J., Judiciary; P. & P., Post Office and Post Roads.

April 11—House.

Kahn (H.R. 201), to regulate air navigation within U. S. and dependencies and between U. S. or any of its dependencies and any foreign country and its dependencies; (I. and F.C.)

Kahn (H.R. 202), to make more effectual provision for aerial defense of U. S. and to provide for concentration of National Air Strength; (M.A.)

Hicks (H.R. 273), to create bureau of aeronautics in Navy Dept.; (N.A.)

Hicks (H.R. 281), to create bureau of aeronautics in Dept. of Commerce and providing for organization and administration thereof; (A.)

Hicks (H.R. 271), to regulate air navigation within the U. S. and between the U. S. and foreign countries; (I. and F.C.)

April 12—House.

Volstead (H.R. 2383), to prohibit use of aircraft insignia by other than government aircraft; (J.)

Ward of No. Car. (H.R. 2482), to establish air mail service along coasts of Virginia and No. Car., between Norfolk, Va., and Beaufort, N. C.; (P. and P.)

Butler (H.R. 2493), to provide for transfer of naval seaplane known and designated as NC-4 to Smithsonian Institution; (N.A.)

April 13—Senate.

Keyes (S. 656), to create a Bureau of Aeronautics in the Dept. of Navy; (N.A.)

Reported back without amendment, April 28; (S. Rept. 6.)
Passed over May 2, 1921.
Passed over June 6, 1921.

Moses (S. J. Res. 24), tendering the thanks of Congress to Lt.-Comm. A. C. Read, U. S. N., for his achievement in completing first transatlantic airplane flight; (N.A.)

April 15—House.

Morin (H.R. 3718), to create Dept. of Aeronautics, defining powers and duties of director, providing for development, production, operation and maintenance of aircraft, and providing for the development of civil and commercial aviation; (M.A.)

April 19—House.

Curry (H.R. 4395), to create Dept. of Aeronautics, defining powers and duties of secretary thereof, providing for organization, disposition and administration of a U. S. air force, and providing for development of civil and commercial aviation, the

(*Concluded on page 358*)

STANDARDIZATION AND AERODYNAMICS

By WILLIAM KNIGHT, M. E.

IN the last two years while I was the Technical Assistant in Europe to the National Advisory Committee for aeronautics I have discussed several times with various people interested in aerodynamics the vital necessity of getting together representatives of aerodynamic laboratories both in Europe and in America for the standardization of the work performed in such laboratories.

Aerodynamics being a new science and not having the traditions which burden the older sciences can easily be standardized and the methods of work adopted in the various laboratories brought into line.

These results, I am convinced, cannot be obtained unless a congress is called of representatives of leading aerodynamic laboratories, without any discrimination between former enemies and former allies and the appointed task of such a congress should be to reach an understanding as to the coordination and standardization of laboratory work which is, in my estimation, absolutely essential to the progress of this new science.

In fact, if we compare the results of tests made on the same models by different laboratories, we shall see that very frequently these results do not agree. I will give two typical examples of this.

1st. The results of tests on wings made by the National Physical Laboratory (N. P. L.) regularly give better polars than those obtained by the Eiffel Laboratory (E. L.). Having noticed this fact, the E. L. tested wings having R. A. F. sections Nos. 14, 15, and 16, the same as those tested by the N. P. L.: the dimensions were, 90 x 15 cm. (2′ 11.4″ x 5.9″); the tests being made at the speeds of 12.2 and 25 m/sec. (40′ and 82′ per sec.). The models tested by the N. P. L. had the dimensions: 45.7 x 7.6 cm. (18′ x 3′) and were tested at a speed of 12.2 m/sec. (40′ per sec.).

The comparison of the diagrams obtained by plotting the experimental results, shows that the models tested by the N. P. L. are better, not only when compared to the plots of the E. L. experiments obtained at 12.2 m/sec. (40′ per sec.), but also when compared to those obtained at 25 m/sec. (82′ per sec.).

During the war, the French Military Aeronautical Technical Section sent to aeroplane manufacturers the results of the tests made on wings in both laboratories, and the difference between the two results led the manufacturers to believe that the wing sections tested by the N. P. L. were better than those tested by the E. L., the truth being, however, that the sections were geometrically similar and that the difference was due either to errors in measurement, or to errors in the determination of the speeds.

2nd. The Göttingen Laboratory, comparing its results as obtained in a closed circuit tunnel, with those obtained in tests on spheres made at the E. L. in a tunnel with a sucking fan, and with those made at the St. Cyr Laboratory in a tunnel with a blowing fan, noted that for certain values of VL/μ the coefficients found were much greater than those found by the E. L. and the St. Cyr Laboratory. The Göttingen Laboratory explains this difference by the aerodynamical nature of the air current, turbulent at the E. L. and at the St. Cyr Laboratory, and non-turbulent at Göttingen.

I may add that the St. Cyr Laboratory has found in two tunnels of different diameters with sucking fans at the diffuser end, the same results as those obtained at Göttingen. We thus see that differences in results may be due, not only to errors in testing, but what is of much greater importance, to the aerodynamic nature of the airflow adopted.

It is out of the question that the present state of things is fraught with danger to the Science of Aerodynamics. As a matter of fact, when these divergencies are brought before the public, and especially before aeroplane manufacturers, as they must inevitably be, confidence in the work of the laboratories will be utterly shaken.

The matter is, therefore, very urgent, and the appointed task of the proposed congress should be to seek out the truth. For this purpose the congress should have first to compare together the results obtained up to date, and then decide on what comparative tests should be made, and what methods could be employed, to ensure uniform results. These should, however, be such that the laws of similitude to be applied in passing from experiments on models to those on full size machines, shall be of great simplicity.

The congress should also have to decide on the types of models and on the conditions of tests. Too many laboratories still use models which are too small, or speeds too greatly reduced, thus leading to results which cannot be utilized, either as to quantity or quality.

The science of aerodynamics should not only seek to obtain uniform results in experimental investigations: it should also serve to facilitate the practical application by technical men of the experimental results obtained in the laboratories. The congress should therefore take up the question of the standardization of symbols and notations.

As regards the symbols employed, we may divide the laboratories into two groups. One group, including the N. P. L. and the Göttingen Laboratory, uses non-dimensional symbols. The other group, comprising the American, French, and Italian laboratories, uses dimensional symbols expressed either in fundamental units such as used in the Kg.-meter-sec. system, or the ft.-lbs.-sec. system, or practical units such as km/hour or mile/hour, and HP (metric or British).

Besides the divergency in the system of units employed by the laboratories for expressing coefficients, there is also divergency in the coefficients used for representing certain experimental results.

As a matter of fact, though everyone agrees to represent wing tests by the coefficients Kx and Ky, the divergency begins with the ratio assigned to these two values, some giving the value of Kx/Ky, others that of Ky/Kx.

For propellers, the results are represented by some by the values of

$$\frac{\text{Power}}{(\text{Rp's})^3 \times \text{Diam}^5} = f(V/nD)\text{; by others,}$$

by the values of $\dfrac{\text{Torque}}{(\text{Rp's})^3 \times \text{Diam}^5}$.

I would also mention divergencies in the aerodynamic characteristics of a streamlined body, which are sometimes referred to the area of the maximum cross-section, and sometimes to the 2/3 power of the volume; also to the disagreement existing in the expression of the mechanical efficiency of wind tunnels, etc.

This multiplicity of coefficients thoroughly bewilders the reader of works on Aerodynamics and puts him under the necessity of transforming the expressions, a labor, moreover, which he rarely undertakes, preferring rather to lay down his book or to read it in a cursory fashion.

The same remarks apply to the notations, that is, to the symbols representing the various values used in the formulas. It is certain that if all laboratories were to adopt the same system of notation, the result would be a great economy of time for everybody concerned in aerodynamics, and the reading of the various reports on the subject would be a pleasure instead of being a burden, as it must be, so long as different notations are used.

We cannot too strongly insist on the fact that when, in reading a Report, we are stopped either by the meaning of a symbol or by the value of a coefficient, it is impossible to follow the sequence of ideas, and the Report is usually thrown aside. In the same way, the standardization of graphical methods of representation would be exceedingly useful. Here, too, at present we find a complete lack of agreement.

To take a very simple example: for wing tests, the N.P.L. gives four curves, Kx, Ky, Ky/Kx in function of the angle of incidence, and Ky/Kx=f (Ky). The E.L. gives the curve Ky in function of Kx on which the angles of incidence are marked.

For the representation of propeller tests, the Central Aerodynamic Laboratory of Rome gives 15 curves: five for thrust, five for power, and five for efficiency, corresponding to five different wind velocities, in function of the speed of rotation.

Dr. Durand of the Stanford University, Cal., gives two curves, Pm/n^3D^5 and P/n^3D^5, two curves Pm/v^3D^2 and P/v^3D^2 (where Pm=Effective Power and P=Useful Power), and one curve for the efficiency, all these curves being expressed in terms of V/nD.

For ordinary tests we should adopt not only the same methods of graphic representation, but also the same scales.

This standardization can be no possible hindrance to development, since, if the suggested Congress meets from time to time it will be perfectly free to modify any previous decision, should such modification be justified by new knowledge and experience acquired.

Another useful task of the proposed Congress would be to adopt a standard method of classification of all publications on Aerodynamics. This would be of great assistance in research work on any given subject.

In advancing this suggestion I wish to emphasize what I said before regarding the participation in such a Congress of representatives of all leading aerodynamic laboratories without any discrimination of nationalities.

I think it is time for everybody to realize that science has no particular nationality.

Unfortunately at the present time in Europe there still exists a tendency in certain quarters to snub and to pretend to ignore the wonderful progress made by the Germans in aerodynamics during the war and for this reason it is not likely that, if the move for calling such a Congress should be originated in Europe, the Germans should be invited to attend it.

Why not take the initiative in this country?

THE SEAPLANE TENDER U. S. S. WRIGHT

IT is now expected that the U. S. S. Wright, the new seaplane tender for the Navy will be placed in commission about August 15, 1921. She will take the place of either the Aroostook or the Shawmut, now being used for that purpose in the Pacific and Atlantic Fleets. The vessel is named in memory of Wilbur Wright.

Arrangements were made with the U. S. Shipping Board late in 1919 for the Navy Department to take over one of the Emergency Fleet Corporation's type B ships, Hull No. 680, then building at Hog Island for the Shipping Board, and to convert the vessel into an aircraft tender for kite balloons and seaplanes for the U. S. Navy. The hull was launched at Hog Island on April 28, 1920, and contract for the conversion work was let to Tietjen and Lang Dry Dock Company, of Hoboken, N. J., on June 30, 1920.

The conversion work now being executed by Tietjen and Lang Dry Dock Company includes additions, changes and alterations necessary to fit and complete the vessel in every respect for sea service, including provisions for the stowage of six kite balloons, for the inflation and housing of kite balloons aft in a balloon well, for the necessary hydrogen generating plant for balloon inflation, for hydrogen stowage, and for efficient repair plants for the balloon and seaplanes.

The vessel is being arranged for flying operations of kite balloons and as a tender for seaplanes, carrying spare wings and other spare parts.

The quarters are being arranged to accommodate the ship's own complement and officers, and officers and personnel assigned to the care and operation of the kite balloons and seaplanes. Berthing and messing accommodations are being provided for the captain, one detachment commander, twenty-eight wardroom officers, twenty junior officers, twelve warrant officers, sixty chief petty officers and four hundred and fifty men. The chief petty officers will be berthed in pipe berths and the crew in hammocks. The hospital space will include: Operating room, treatment room, sick bay bath, isolation ward, surgeon's room, dispensary, isolation bath, sick bay, and dental office. The commissary space will consist of: Officers' and crews' galley, potato peeler room, bakery and bread room, cold storage, general mess issuing room and butcher shop.

There will be a barber shop and a fully equipped laundry. An aerological laboratory and pigeon coop are being provided; also a photographic laboratory, together with dark room, developing room, and printing apparatus. A hydrogen generator of large capacity, constructed to use salt water for cooling, a number of hydrogen compressors, a large number of hydrogen flasks and an air blower for the kite balloons and two balloon winches will be installed for use in the flying operations and inflation of balloons.

The repair facilities will consist of the following: Wire assembly shop, tool issuing room, blacksmith, foundry, sheet metal and coppersmith shop; carpenter and pattern shop, machine shop and motor erecting shop; electrical work shop; fabric and dope shop. Two balloon winches are being fitted for use in flying operations of balloons.

A large space forward is provided for wing section stowage, and a large hatch in the weather deck for the purpose of getting the wing sections below. Space will also be available for the stowage of spare parts for kite balloons and seaplanes, for boatswain stores, canvas and awnings, lumber, pipe, bar, plate, and metal racks, engineer's stores, electrical stores, chemical stores, officers' stores, etc.

The battery will consist of 4-5" 51 calibre guns, two forward and two aft, also two machine guns. Ammunition stowage is provided for the regular allowance of ammunition for these guns. The principal dimensions, etc., of the U. S. S. Wright are as follows:

Length over all	448 ft.
Length between perpendiculars	448 ft.
Breadth molded	58 ft.
Draft	31 ft.
Displacement (normal)	14,240 tons
Speed (about)	15 knots

A COMMERCIAL AVIATOR'S UNIFORM

FROM time to time we have borne testimony to the good work being done for American aeronautics by Pilots Runser and Turner and now we have to congratulate them on the development of a commercial aviator's uniform which seems to fit the bill admirably.

Flying is pre-eminently the de luxe mode of travel and everyone engaged in passenger carrying and commercial work should do their share in upholding the high standards which the best interest of aeronautics demand.

In a letter which we have just received from Turner, he sums up the case aptly:

"The advantage of uniforms is that they are cheaper than civilian clothes from the standpoint of wear and cleaning. After a day's work is done you can take a towel and Carbona and clean all spots. Then you are ready to go to dinner or theatre, dance or any place. Your dress is suitable for all occasions. It further stimulates and advertises aviation. It shows that you mean business and can command respect. It is then your duty to uphold the dignity of the uniform and calling as there is none other any better. Opportunities are unlimited in the air.

"If you look like a tramp or blacksmith how can you expect to meet the people that are able to support your business? It is impossible to keep clean or pressed up all the time and work with an aeroplane. A uniform is your only hope to look presentable.

"The only disadvantage of the uniform is that of hot weather, but you become accustomed to that, for when on the flying field you are in your shirt sleeves and so that does not make so very much difference. A person can not have everything one way, so there must always be advantages and disadvantages.

Messrs. Runser and Turner wearing the special commercial aviator's uniform which they designed

"If the American commercial flyers will adopt this uniform for flying they can easily see what it is worth to all aviation as well as themselves from an advertising standpoint."

Following is a description of the uniform, which can be secured from the Brooks Uniform Co., New York City:

Caps are leather and overseas style with strap over top, ensigna is of gold embroidered wings, and silver propeller on black background; leather buttons; wings are gold with silver disc, and blue star with red dot in center, name is engraved around edge of disc; two gold bars on left sleeve, designating two years commercial service; Sam Browne belt.

Air Mail Pilot Examination

The United States Civil Service Commission announces an open competitive examination for aeroplane pilot. Vacancies in the Air Mail Service of the Post Office Department at base salary of $2,000 a year, with additional pay on a mileage basis and vacancies in positions requiring similar qualifications, at this or higher or lower salaries, will be filled from this examination, unless it is found in the interest of the service to fill any vacancy by reinstatement, transfer, or promotion.

Applicants should apply for Form 1312, stating the title of the examination desired, to the Civil Service Commission, Washington, D. C. Applications close July 5.

AEROPLANE BALANCE

By L. HUGUET

(Technical Note from the National Advisory Committee for Aeronautics)

Relative Influence of the Various Constituent Elements of an Aeroplane on Longitudinal Stability in Flight

THE position of the center of gravity has a preponderating influence on the longitudinal stability of an aeroplane in flight. Constructors have long been aware of this influence, and, nevertheless, many of them are still content to apply empirical rules to the balancing of their machines.

The results thus obtained are usually very unsatisfactory, corresponding, moreover, to the rules applied. Only those experienced in Aviation, those who have had the opportunity of making many tests and who are capable of drawing correct conclusions from their numerous experiments —only such men can work with any certainty. Others are, for the most part, content either to apply a vague, general law, or to balance their machine for a particular case of flight. In the latter case, they place the center of gravity in a position compatible with that of the resultant of the actions of the air on the cellule, and even such resultant is very vaguely defined by the polar of the wing utilized.

Balance obtained under such poor conditions is rarely satisfactory. The maneuverability of such machines is rarely all that could be desired. In order to improve it, the constructor makes slight changes here and there, he alters the tail, the position of the planes, etc., but, just as vagueness reigned in defining the center of gravity, so these modifications are determined more by guesswork than by logic.

The problem of balance may, however, be discussed.

The metacentric curves given in the laboratory have already enabled various authors to take up this discussion.

We are generally led to define the rules of balance through our search for the conditions of longitudinal stability of the aeroplane. As we shall see further on, the application of these rules nearly always involves recourse to wind tunnel tests, the only tests which enable us to find the laws characterizing the equilibrium of the glider.

The lines of the following discussion were suggested by the very interesting system of curves which the Schneider Works recently had drawn up by the Eiffel Laboratory for the glider corresponding to the all-metal machine of 9 tons which that firm is now making. This system of curves was drawn up as the result of investigations on the balance of machines presented to the S. T. Aé. and which, in free flight tests, were found to be wanting in controllability.

The Laboratory was requested to make experiments on a reduced model for the purpose of determining, for this glider, the displacement curves of the center of total thrust when the angle of attack of the cellule varies and when the setting of the tail varies.

These experiments are, first, of theoretic interest, for the curves obtained enable the fundamental problem of longitudinal stability to be discussed in a very satisfactory fashion.

They are also of great practical interest, seeing that the results furnished agree almost perfectly with those previously noted in free flight tests of modern machines.

Also, by the wind tunnel test of the reduced model they supply the means of determining whether the full-sized aeroplane is well balanced, whether the tail surfaces are sufficient, well placed and efficient.

Actually, an aeroplane is said to be well balanced when its center of gravity is from ⅓ to ¼ forward on the chord of the straight-edged cellule which is equivalent to the cellule of the aeroplane.

The results of the above mentioned experiments are in agreement with this rule, though they show its insufficiency.

They also show the advantages and disadvantages of placing the center of gravity further forward or backward on the wing.

The tunnel tests were carried out as follows:

A complete glider with its tail surfaces was placed in the airstream of the tunnel. The horizontal surfaces consisted of a fixed plane, *having its chord parallel to the wing chord,* and a movable plane (the elevator). These *were of symmetrical profile.*

The displacement curves of the center of thrust for the whole of the glider were plotted for different constant settings, a, of the elevator, as function of the angles of attack of the cellule.

There is a curve for each angle a.

The system of curves has the general sweep shown in Fig. 1, where the angles of attack (1) are laid off as ordinates; the distances from the center of thrust to the leading edge of the wing are laid off as abscissas and estimated in % of the chord of the wing.

Each curve of displacement of the center of thrust is defined by the a of the setting.

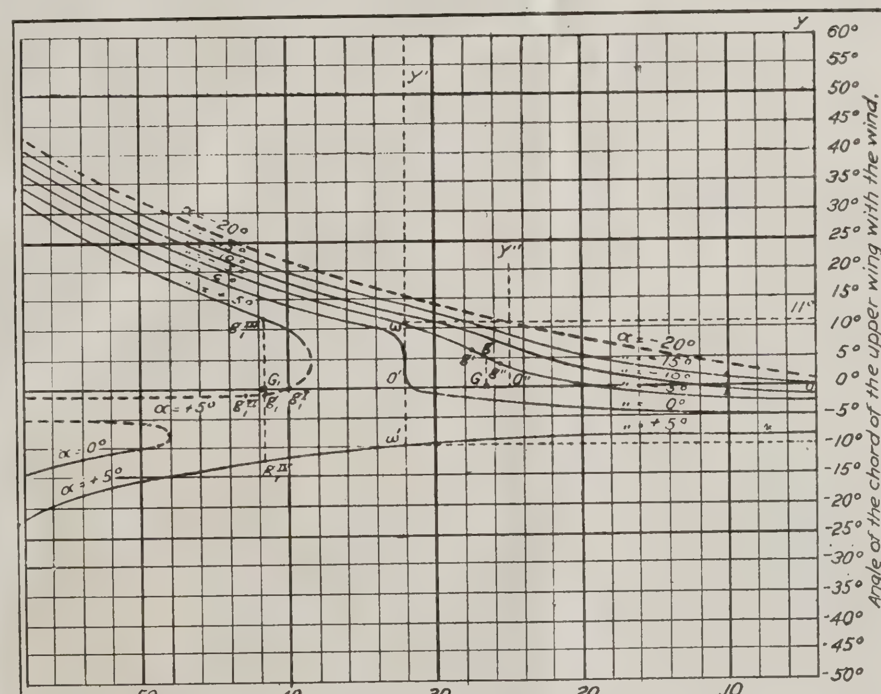


Fig. 1 Distance in per cent of the chord of the wing from the plane passing through the leading edges of the wings.

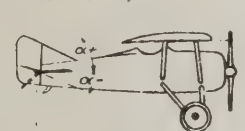


Fig. 2

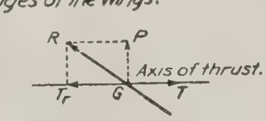


Fig. 3

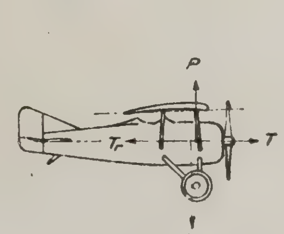


Fig. 4

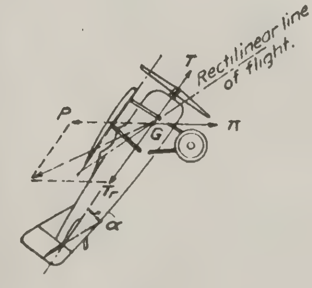


Fig. 5

The angle a of the elevator is measured from a direction parallel to the chord of the wing: it is reckoned as positive above the chord (a setting which makes the aeroplane dive) and negative below.

The point whose displacement we are studying and which we call conventionally the center of thrust is not a metacenter, but simply the point at which the resultant of the actions of the air intersects the axis of thrust of the propeller.

The position of this point for a given angle a and angle of attack i, will be the abscissa of the point of this curve a, the ordinate being i.

For a clear understanding of the following discussion it must not be forgotten that we always assume the total resultant of the actions of the air to be decomposed into two forces (Fig. 3):

One, along the axis of thrust of the propeller and opposed to the thrust; the other vertical, directed in the sense opposed to the action of gravity.

The following discussion bears upon the curves obtained for this special glider, but the conclusions drawn are of general application, for all the gliders of the usual machines of today are of the same kind and give rise to similar systems of curves.

These curves may vary in form, distance, and position, as we shall see, but such variations do not at all change the conclusions derived from the discussion.

Besides the fundamental test which serves as a basis for this study, other tests have been made on the same glider with tails of varying shapes and dimensions; further on we shall see what interest such tests present.

For the present we will only study from a statical point of view, in the case for which a uniform and rectilinear regime of flight is established, the equilibrium of the forces entering into play and determine the conditions under which the equilibrium considered will be stable, deducing, if possible, from such conditions the precautions to be taken in constructing machines in order to ensure their being stable and manageable.

We will examine the following points:

1st. The longitudinal stability, in flight, of a glider with coinciding centers, assuming that we have a power such that we can always by the thrust of the propeller, balance the component of the forces opposed to thrust.

2nd. The influence exercised on the stability of flight by the position of the axis of thrust with respect to the center of gravity and the whole of the glider.

3rd. Stability on the ground before taking off, and the influence of the position of the landing gear.

4th. The influence of the elements of the glider on the balance, the possibility of sometimes correcting defective balance, and the valuable information given on this point by wind tunnel tests.

5th. A brief examination of the equilibrium of power in horizontal flight, where the conditions of stability peculiar to this kind of flight are added to the previously existing conditions of the stability of the glider, and interfere in fixing the safety limits of certain evolutions.

1st. Longitudinal Stability of the Glider With Coinciding Centers

We shall first discuss the longitudinal stability of the glider on the assumption that the aeroplane has coinciding centers; that is, that its center of gravity is on the axis of thrust of the propeller.

In this case, according to the decomposition of the forces already considered, only the resultant of lift can affect the longitudinal stability of the machine. (Fig. 4).

We shall further assume that there is always a regime of flight established such that (Fig. 5) the component P will be equal to the weight U and T (propeller thrust) will be equal and opposed to T_r (resistance to thrust. For the moment we shall not take into account the magnitude of the relative speed which we shall assume to be always such that the component of lift will balance the weight U.

Condition of Balance.—For the machine to be balanced, the center of thrust must be on the vertical through the center of gravity.

It is very clear on Fig. 1 that, for a given angle of attack and a given center of gravity, G, of the glider, balance is only possible for one clearly defined setting of the elevator.

For a given setting of the elevator and a given angle of attack, balance only occurs if the center of gravity occupies a clearly determined position.

For instance, the point g, corresponding to $\alpha = -5°$ and $i = +5°$, defines a state of equilibrium for the center of gravity G.

Region of Stability.—In the whole region comprised between oy and o'y' for which oo' is almost ⅓ of the chord of the wing, the positions of equilibrium correspond to stable equilibriums, whatever be the angle of attack.

The position of equilibrium characterized, say, by Gg is stable. In point of fact, each accidental variation, $+$ di or $-$ di, of the angle of attack i, corresponds a displacement of the center of thrust gg' or gg'', such that the thrust gives rise to a torque, correcting, in each case, the accidental deviation, without the pilot having to interfere or change the setting α of his elevator.

Point g', corresponding to an increase in the angle of attack, is in the rear of G, and therefore the corresponding thrust tends to make the machine nose-heavy so long as g' has not returned to the vertical of G.

On the contrary, g'', corresponding to a decrease of the angle of attack, is in front of G, so that the thrust tends to make the machine tail-heavy.

Region of Neutral Equilibrium.—On Fig. 1 there is a curve $\alpha = 0°$, a flattened curve of vertical inflexion, coinciding with o'y'.

If we assume the center of gravity of the aeroplane to be at 0' and the elevator set at the angle $\alpha = 0°$, the machine will be balanced for all angles of attack comprised between 7° and 1°.

This shows that at small angles of attack, the aeroplane will be balanced with a suitable position of the center of gravity and a given setting of the tail, at any angle of attack within the given limits.

At large angles of attack, for the same position of the center of gravity, balance is assured with tail settings of large absolute value, and we see on the α curves that equilibrium again becomes stable.

Region of Unstable Equilibrium.—We shall now suppose the center of gravity to be situated to the left of o'y' at G_1. At small angles of attack there is for a setting α of the elevator, a position of equilibrium characterized by a point on the curve α, say g_1.

This position of equilibrium is unstable. In fact, to an accidental increase, $+$ di, of the angle of attack, corresponds a displacement g_1, g'_1 of the center of thrust, and the resulting torque tends to make the machine still more tail-heavy.

If the pilot keeps the elevator setting fixed, the nose of the machine will rise until g'_1 returns to g''_1 above g_1, where equilibrium is stable[1].

To an accidental decrease $-$ di of the angle of attack, corresponds a displacement g_1 g''_1 of the center of thrust, and the resulting torque tends to further increase the nose-heaviness of the machine; the equilibrium is no longer stable, for at g^{iv}_1 below g_1, the equilibrium is also unstable.

Thus, for an aeroplane balanced too much to the rear, equilibrium is only stable at large angles of attack of the cellule.

At large negative angles of attack, balance would only be stable if we considered a regime of flight with the machine inverted.

Region of Impossible Maneuver.—If the tail has a minimum setting, say $\alpha = -20°$, the system of α curves is limited to this curve $\alpha = -20°$.

If the center of gravity of the aeroplane is sufficiently forward between o'' and o, there are no elevator settings which allow of finding a position of equilibrium at large angles of attack (greater than $i = 11°$, for instance).

The ceiling of the machine is then determined by this maximum angle of attack compatible with the controls. The machine loses part of its flying qualities through being badly balanced.

If the machine should happen to be placed in such conditions of flight that its angle of attack exceeds $i = 11°$, it cannot keep such a position and will nose dive until the maximum angle of attack compatible with its balance is reached.

In such a case, the machine has no maneuverability at large angles, while having excessive stability at small angles.

When the elevator setting is not limited by construction, the action of the controls is none the less limited for each value of i to a maximum setting such that $\alpha + i$ (Fig. 6) is the angle at which the tail plane reaches its maximum K_y.

If we increase or reduce α beyond this value, the K_y of the tail plane decreases, and the action produced by the elevator is the reverse of what would be normally produced by a larger setting of the elevator.

Thus, even with an elevator which can be set to any angle, there is a limiting curve which, for a given center of gravity, determines a maximum angle of attack, beyond which the machine is unable to maintain its flight.

It should be noted that with elevators which can be set at any angle, it is possible to fly with the elevators set at an angle greater than that required for maximum efficiency, but in such a case the action of the controls is reversed.

The curves shown on Fig. 7 are those of a glider having a tail of small relative area, but altogether mobile; the figure shows that the curve $\alpha = 0°$ and $\alpha = -3°$ intersect each other, thus indicating that, for sufficiently large angles of attack the setting $\alpha = -3°$ reaches and exceeds the setting required for maximum efficiency.

The foregoing remarks only apply to the longitudinal equilibrium of the glider, independently of the axis of thrust of the propeller, drag, and available power. From these remarks it results that, with current wings and *the dispositions of tails usually employed;*

1st. *Machines having the center of gravity very much forward* (in front of o'') cannot fly at large angles of attack, and are consequently unable to reach the ceiling for which they are fitted by their aerodynamical characteristics.

Also, they can only land at small angles of attack, and their landing speed is, therefore, much too high.

These machines have far too much autostability at small angles of attack.

(To be continued)

AEROPLANE SUPERCHARGERS

By W. G. NOACK

Former Engineer, Board of Aeroplane Experts, Charlottenburg

(*Concluded from last week*)

Another supercharger, having a capacity of 1,000 kg/hr. with an initial pressure of 0.56 atmosphere and a final pressure of one atmosphere (Figs. 30 to 32), requires from 28 to 30 h.p. and is designed for direct connection to an engine of from 260 to 300 h.p. at 1,600 r.p.m. Its impellers make about 10,000 r.p.m. and have a diameter of 290 mm., giving a peripheral speed of 150 m/sec. The driving wheels have 82 and 13 teeth of 2.5 π circular pitch and a face width of 25 mm. The dependence of the final pressure upon the amount delivered at the different speeds is shown in Fig. 33.

The coupling (Figs. 34 to 36) was specially designed to meet the objections of engine manufacturers to the direct attachment of the superchargers. As a matter of fact, the impeller of the supercharger represents, in spite of its small dimensions, a gyrating mass which, in consequence of its great rotational velocity, has approximately the same kinetic energy as that of the airscrew at the other end of the crankshaft. It was therefore feared that synchronous vibrations might arise in consequence of which the shaft might break. For the large superchargers having their own engine the leather packing at the circumference of the coupling is probably sufficient, nevertheless it is also advisable in this case to reduce the vibrations by means of a flywheel.

For superchargers for single engines, couplings with helical springs were therefore used and which proved successful throughout. In tests made with scribers mounted on the circumference of the two disks, the deflection of the springs was obtained during operation. Shocks were thereby noted corresponding to four times the normal torque. The disks and the springs which transmit the torque form a universal joint, so that the vibrations of the entire supercharger in relation to the engine (which owing to the intense vibrations of the engine and the light wooden frame of an aeroplane are unavoidable) may be taken care of. The weight of the supercharger with driving gear is 54 kg., the throttle arrangement (Fig. 6) weighs 4½ kg., and the spring coupling weighs 6 kg.

Brown, Boveri & Co. (Mannheim branch) also produced superchargers for 350 h.p. aeroplane engines and having a driving ratio of 1,350 to 10,000 r.p.m. (Fig. 37). The pressure pipe from the supercharger was directed downward and connected to an air cooler of aluminum, which was to be inserted between supercharger and engine. Suction pressure p_1 in relation to the quantity of air delivered for various r.p.m. of the engine, with a constant final pressure p_2 = one atmosphere and constant suction temperature $t_1 = -15°$ C.

Tests to determine whether the installation of this cooling apparatus resulted in an increase in engine output sufficient to justify the additional weight of from 10 to 15 kg. were not completed.

For the giant planes of 1,800 to 2,000 h.p., yet another kind of supercharger with a special drive by a 160 h.p. Daimler engine had been almost completed, and also a special design of the 1,200 h.p. supercharger with vertical shaft which was to be installed in the 1,000 h.p. single screw aeroplane

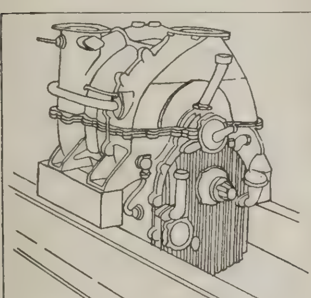


Fig. 30

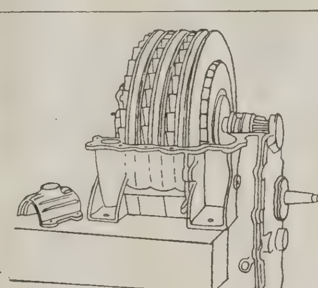
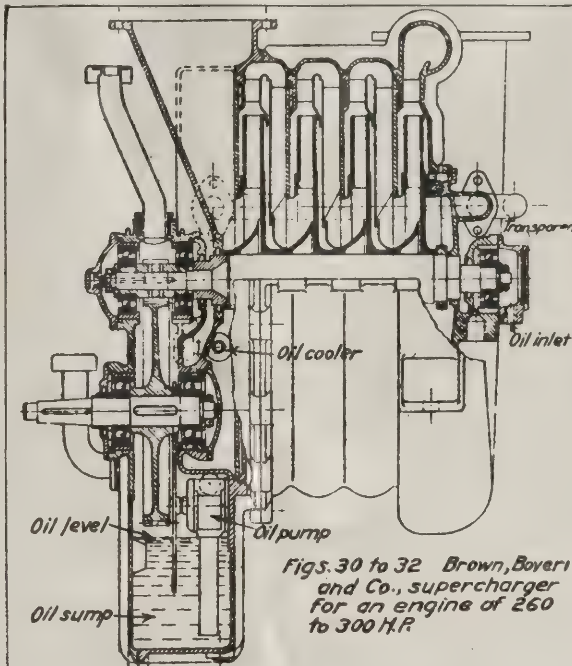


Fig. 31



Figs. 30 to 32 Brown, Boveri and Co., supercharger for an engine of 260 to 300 H.P.

Fig. 32

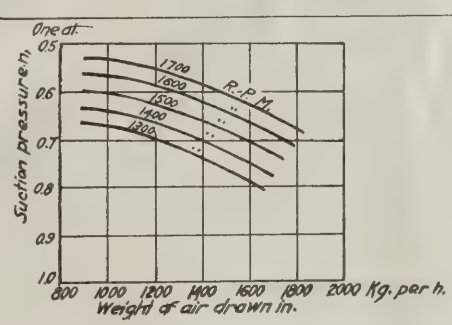


Fig. 33. Curves giving performance of the airplane supercharger, Brown, Boveri and Co., shown in Figs. 30 to 32.
Suction pressure p_1 in relation to the quantity of air delivered for various R.P.M. of the engine, with a constant final pressure p_2 = one atmosphere and constant suction temperature $t_1 = -15°$C.

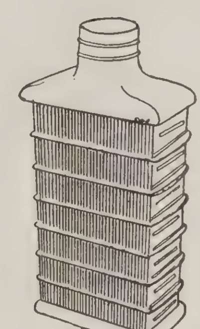
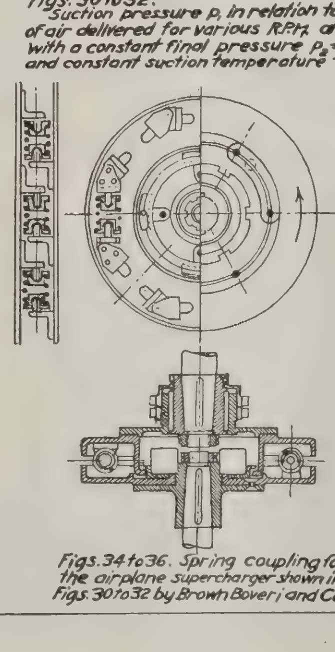


Fig. 38 Air cooler of aluminum.



Figs. 34 to 36. Spring coupling for the airplane supercharger shown in Figs. 30 to 32 by Brown Boveri and Co.

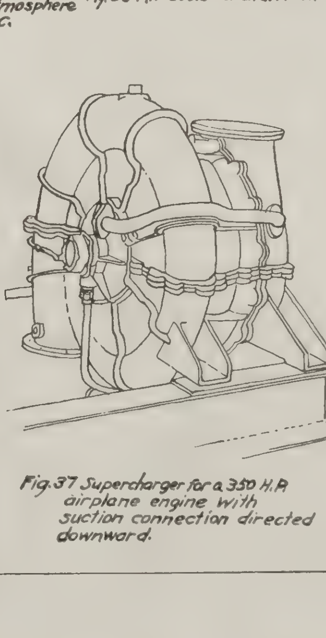
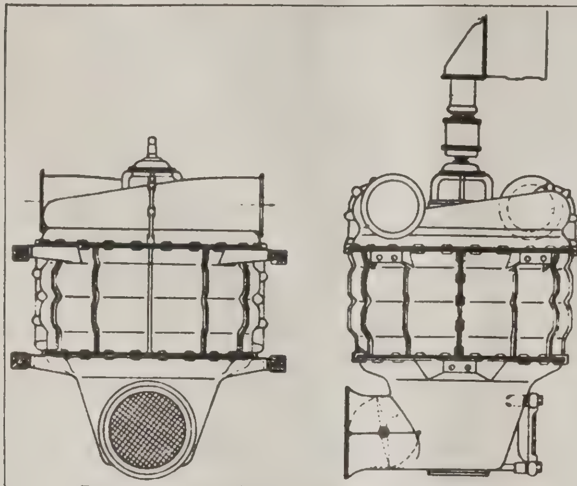


Fig. 37 Supercharger for a 350 H.P. airplane engine with suction connection directed downward.



Figs. 39, 40 Vertical supercharger for a 1000 H.P. plant

of the Linke Hoffman Works of Breslau and driven direct from a central power plant (see Figs. 39 and 40). The transmission gear between propeller shaft (540 r.p.m.) and supercharger shaft (6,000 r.p.m.) is built into the housing of the central power plant.

The A.E.G. (Hennigsdorf) was also successful with superchargers built in its turbine factory (Fig. 41). This supercharger is driven through an automatic centrifugal clutch of which one member is mounted on the end of the engine crankshaft. This clutch engages only when the engine speed ex-

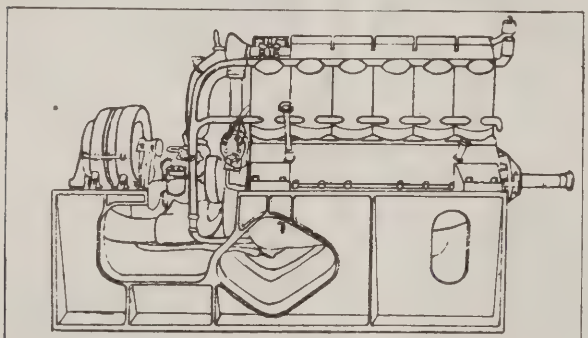


Fig. 41 260 H.P. airplane engine with A.E.G. supercharger

ceeds 600 r.p.m. and then only by the friction of the gripping surfaces. The latter were originally faced with Ferodo fiber, but as this material is difficult to get in Germany, the clutch was converted into a centrifugal type with rocker arms. Between the clutch and the supercharger are inserted a pair of spur gears with a ratio of 1 to 6.9. This is followed by a small intermediate shaft with a square block type universal joint, affording a certain amount of flexibility to take care of slight changes of the bearings and of the vibrations during flight. At the same time this shaft forms a yielding member and a safeguard against fracture, thus protecting the crankshaft in case of rapid acceleration or obstruction within the supercharger.

The three impellers run at 10,000 r.p.m. and consist of steel disks with vanes riveted on. The diffuser case has a horizontal joint through the center. The pressure ratio is 1.7 at full speed which corresponds to a constant output of the engine up to an altitude of 4 km. When attaching the supercharger to the 260 h.p. Daimler engine the usual suction elbow to the carburetor is replaced by a connection piece with automatic valve and throttle valve. The air is drawn through the channel of the crankcase and passes through the swinging valve (which opens automatically) directly into the carburetor, when the throttle device in front of the supercharger is closed. Then the supercharger will be running light. If, on the other hand, the throttle valve is opened the automatic valve will close and the air passes to the engine through the supercharger. The swinging valve can be adjusted to the various altitudes from the pilot's seat by means of a Bowden wire; it can, however, also be automatically controlled by means of a barometric cell.

The supercharger requires about 10 per cent of the engine output, and its weight is 56 kg., including pipes and coupling. In the later models the coupling alone weighs 9 kg., and the weight of the parts necessary for the installation attachment is also 9 kg.

The A.E.G. also made superchargers with separate drive for giant aeroplanes (Fig. 42).

The Siemens-Schuckert Works also built and tested super-

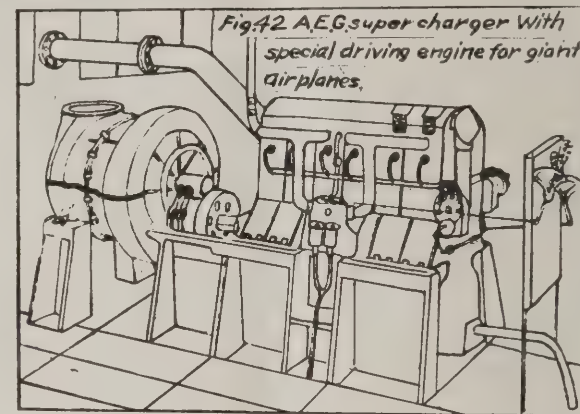


Fig. 42 A.E.G. supercharger with special driving engine for giant airplanes.

chargers which had been designed for direct attachment to the 260 h.p. Daimler engines, in combination with their rotary engines, but full flight trials were forestalled by the signing of the Armistice. The main difference, as compared with the other models of superchargers, is that the spur wheel transmission gear with intermediate wheel is fitted at the propeller end of the crankshaft (see Fig. 43). The compressed air passes to the carburetor through a pressure pipe located outside of the fuselage.

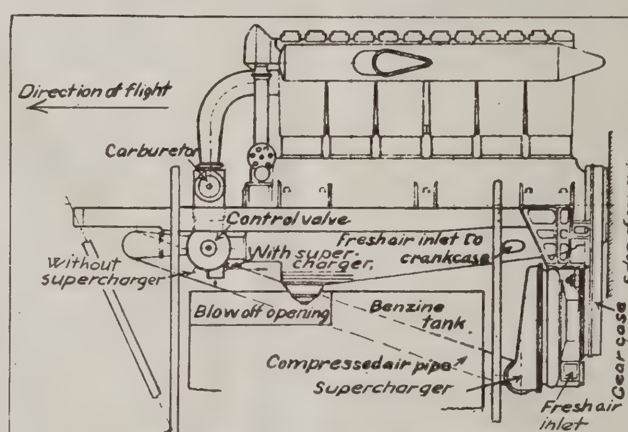


Fig. 43 260 H.P. airplane engine fitted with Siemens Schuckert supercharger and control valve

Just ahead of the carburetor is placed a change-over valve, which gives the pilot the choice between taking air from the atmosphere through the channel in the crankcase, or compressed air form the supercharger (see Fig. 44). The supercharger is a two-stage type and supplies an increase in pressure of 27% at ground level (b 750 mm., t 19° C.) when running at 6,900 r.p.m., or a peripheral speed of 145 m/sec. The supercharger for the 115 h.p. revolving cylinder engine

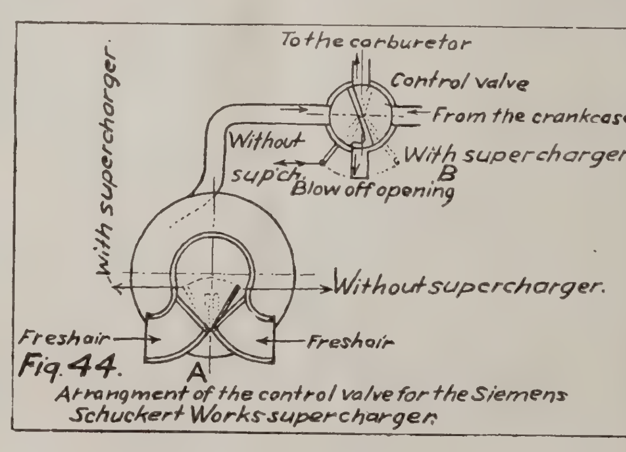


Fig. 44. Arrangment of the control valve for the Siemens Schuckert Works supercharger.

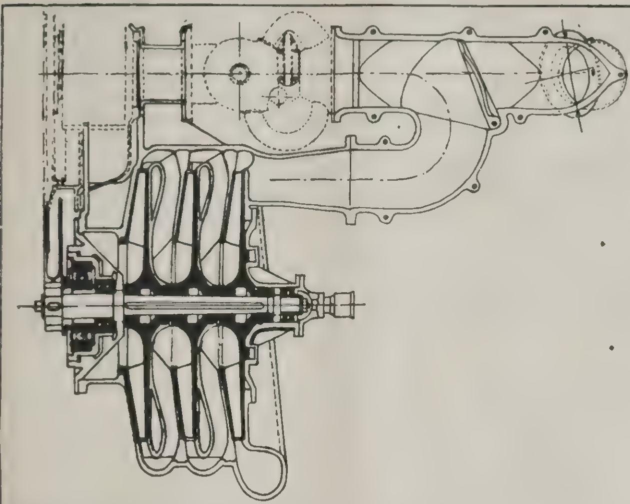


Fig 45 Three stage supercharger for the 115 H.P. revolving cylinder engine of the Siemens Schuckert Works

(Fig. 45) is a 3-stage supercharger and supplies an increase in pressure of 30% at ground level when running at 8,600 r.p.m. The power consumption is 11.5 h.p. for 6.5 cu.m. of air drawn in per minute. With its drive this supercharger weighs 28 kg.

With engines of constant output the airscrew problem became one of special importance. With the decreasing density of the air the thrust and the torque of the screw decrease also. But, as the engine with supercharger retains its ground level power output, the speed of the screw is excessively increased. For adapting the power absorbing capacity of the propeller to the density of the air there are various alternatives of which 3 which have already applied will be mentioned here.

First:—By changing the number of revolutions of the screw by means of a variable speed gear, the engine driving two sets of bevel gears of different diameters, whereby a reduction in speed from 1,400 r.p.m. to 900 or 1,000 r.p.m. may be effected.

Second:—By varying the pitch. Several types of these screws have been tested, but the only one that has actually been used is that designed by Prof. Reissner, and manufactured by both the Helix Propeller Works of Breslau and the Hirth Experimental Construction Station at Cannstadt. This propeller has been installed with two different models of the adjusting mechanism. Blades mounted on a hollow shaft are shifted by means of a rod sliding through the shaft and connected to the blades by a linkwork. Blades mounted on the solid shafts are shifted by moving a ring controlled by a bevel gear mechanism and which is connected with the blades by two links. These propellers are now also arranged for automatic control by means of a centrifugal governor.

Third:—By changing the number of revolutions by regulating the engine. For this an ordinary airscrew is used but with a greater pitch than usual. As the power absorbed by a propeller increases as the third power of its speed of revolution, but decreases only as the first power of the air density, at an altitude of about 6 km., at which the air density is only about ½ that at ground level, the speed of revolution of the propeller needs to be increased in the ration of $\sqrt[3]{2} = 1.2599$, or by about 26% if its power-absorbing capacity is to remain the same as at ground level.

With most aeroplane engines the power curve is rather flat in the vicinity of the customary number of revolutions, below which the torque increases with decreasing r.p.m. With a given screw it is therefore possible to maintain constant power from the ground to an altitude of 6 km., if the speed is changed only from 1,200 to 1,500 r.p.m. By supplying air at slightly above sea level pressure, we are able to overload the engine somewhat so that the aeroplane can take-off with the engine at 1,300 instead of 1,200 r.p.m. Generally speaking, screws that are designed for an altitude of 3 km. with regard to density, number of revolutions, and air speed, may be considered adapted for use on engines with constant output up to an altitude of 5 km. Nevertheless, this is a compromise which involves the disadvantage that within the increased engine speed range there is likely to be a critical speed of the engine at which the latter vibrates excessively and causes breakage of fuel oil pipes or water pipes.

In order to better judge the superiority of an aeroplane which is equipped with a supercharger, we refer to the following:

(1) *Flying Speed:*—As the density of the air decreases the resistance of an aeroplane diminishes, but so also does its carrying capacity. With aeroplanes equipped with ordinary engines this necessitates an increased angle of the wings, thereby increasing the driving resistance. With constant engine power it is possible to increase the speed as air density decreases, thus maintaining nearly a constant angle of incidence at increasing altitudes. The velocity v at any given altitude with the prevailing air density y is $v = v_0 \sqrt{\frac{y_0}{y}}$, in which v_0, y_0 are the corresponding values at ground level.

(2) *The Climbing Speed:*—The climbing speed remains the same theoretically up to the altitude at which the engine still shows its ground level power. From then on the rate of climb decreases in proportion to the decrease in the density of the air in front of the carburetor.

(3) *Ceiling:*—The ceiling of the aeroplane continues to be raised until the air in front of the carburetor furnished by the supercharger has become rarefied to an extent which would have served to just barely sustain the aeroplane without the supercharger.

The foregoing considerations are applicable to aeroplanes when making flights for the purpose of practical comparison. In Fig. 46, as shown, the average ascension curves of a 1,000 h.p. giant aeroplane, with and without a supercharger, but with approximately the same total weight. For the flight shown in Fig. 47 the additional output of the supercharged aeroplane was 130 kg., which corresponds to the additional weight of the two superchargers with accessories.

In this connection, the use of a gas turbine* for driving the supercharger was also advocated. The gas turbine was to use the exhaust gases of one or more main engines. Theoretically there seems to be nothing to prevent this. The available energy also appears to be sufficient even with a turbine of moderate efficiency. However, the additional weight and the lack of simplicity of the engine plant of the aeroplane are disadvantageous. Difficulties may also be expected from the back pressure on the exhaust gases at the exhaust valves.

* See "Zeitschrift," 1919, p. 418, and "Luftpost," 1919, Nos. 13 and 15.

(*Concluded on page 359*)

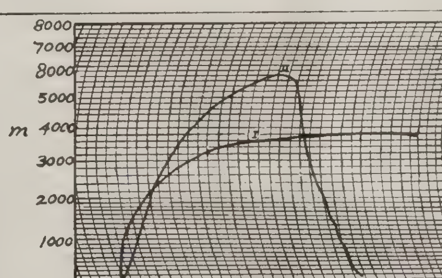


Fig 46: Barograph curves of a Staakken 1000 HP giant airplane with and without supercharger.
I Average climbing curve without supercharger
II Climbing curve with supercharger and "compromise" screw

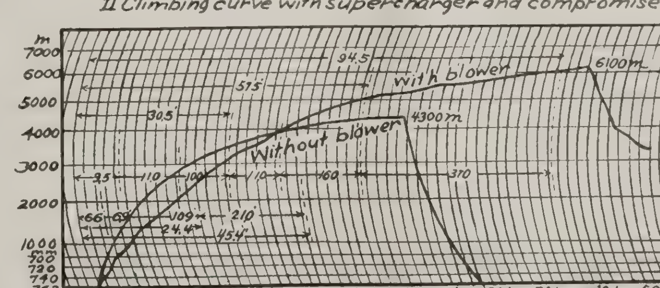


Fig 47 Barograph curves of an AEG-G airplane with and without supercharger

FOREIGN TECHNICAL DIGEST

Salmson Type, AZ9—300 H.P.

The design of this engine was commenced in 1918, but after the armistice it was developed into a purely commercial engine. Like most of the motors constructed by the Société des Moteurs Salmson, it is a fixed radical water cooled; with nine cylinders, 140 by 170.

The cylinders in mild steel are surrounded by a water jacket of pressed steel. There are two inlet and two exhaust valves per cylinder. The crankshaft is of 70 mm. diameter and comprises only one throw, the front web carrying the airscrew shaft. The ignition is by two magnetos, Salmson type GG9, and each cylinder has sparking plugs of 24 MM. instead of the usual 18 mm. For large aeroplanes the engine carries a reduction gear of 1.5 to 1, obtained by an epicyclic gear on the airscrew shaft.

For normal power 300 h.p. at 1,500 r.p.m., the motor weighs 330 kg., which is 1.1 kg. per h.p. The consumption is 230 g. of petrol and 25 g. of oil per b.h.p. hour. (*L'Aeronautique*, Jan., 1921. 1 p., 1 fig.)

The Westland Six-Seater

A new machine has been built to the order of the Civil Aviation Department, and is to be kept at Croydon Aerodrome, and used partly for experimental work in connection with night flying on the London-Paris route. The aeroplane is almost a replica of the one with which the British Air Ministry Competition (small class), for civil aircraft, was won last year, but several minor differences and improvements have been incorporated. The wheels are now 900 to 200, and the brake drums are built in the wheel, and not attached as a separate unit, as was previously the case. The whole brake gear has also been strengthened up, and is very much more powerful. The lateral control has been modified, and ailerons are now fitted to the top plane only. The cables work through large bell crank arms in the bottom plane, no pulleys whatever being fitted in the control system. This is a big advantage, as it minimizes one of the points which needs most careful attention, *i.e.*, the fraying of the controls.

The petrol system has been altered, and the carburetters are now supplied by air pressure feed instead of pump. An emergency hand-pump is fitted, and should the petrol system fail, petrol can be drawn from either of the main tanks and pumped up to the gravity tank. The total petrol capacity is 99 gals., or sufficient for about 5½ hours' flight, cruising speed. The machine carries five passengers in addition to the pilot. The total airworthiness weight has been raised to 6,000 lbs., as against 5,850 lbs. for the competition machine, and this now gives a disposable load of 1,200 lbs. The machine is very luxuriously upholstered, fitted with electric light, and also completely wired for night flying. (*Aeronautics*, May 12, 1921.)

The Austin Life-Float

On aerial services where more or less of the journey is made over water it is desirable—not to say essential—that some form of protection against the risk of drowning in the event of a forced descent should be provided. This is particularly so as regards land machines, but even a seaplane or flying boat may damage its float or hull and sink. Messrs. W. J. Austin and Co., of Swansea, well known as specialists in life-saving apparatus for marine services, have designed a "life-float" or raft specially for use on aircraft, and we understand that satisfactory tests with it have been carried out before the Air Ministry.

This "life-float" is of the collapsible type, taking up but comparatively little space, and is capable of supporting four persons. It consists of two compressed air cylinders, over which are secured two tubes of balloon fabric in the manner shown in the accompanying sketch. One end of each tube is secured to the center of the compressed air cylinder so that the ends of one tube abut the ends of the other, thus forming a tubular ring with the air cylinders located within. Each cylinder has a valve communicating with the tubes, and on opening the valves the latter are immediately inflated, producing an oval-shaped ring of considerable buoyancy. Suspended some two feet below it, by means of fabric bands passing over the tubes, is a folding wooden platform, upon which the occupants stand. A wall of net may be fitted between the platform and the tubes, to prevent anyone from slipping "overboard."

When in use this life-float is 7 ft. long by 4 ft. wide, the diameter of the inflated tubes being 1 ft. 4 ins. When deflated, it folds up to an overall length of 5 ft. and a width of 1 ft. 3 ins.; the depth then is only 6 ins. The approximate weight is 56 lbs. (*Flight*, May 12, 1921.)

Meteorology in the Service of Aviation

This paper was read before the British Royal Aeronautical Society by Major G. Dobson. Following are some excerpts:

It has been supposed that meteorology must necessarily be of very great importance to aeronautics, and that important as it may be to, say, marine work, the services which it can render to aviation are still greater. It may not be without interest, therefore, to discuss in what ways it can be of most assistance; how an ideal meteorological service might be organized, and how far it is likely to satisfy the demands made upon it. We do not propose to discuss what should be done in the immediate future, since this is complicated by so many considerations, such as the financial outlay which is justified by the existing volume of aerial trffic. But to simplify our question, let us imagine a time when the amount of aerial traffic will be so great that the financial considerations involved would justify any outlay that we are likely to propose. Such a time may be supposed to be many or few years ahead, according as one feels, pessimistic or optimistic, regarding the future of commercial aviation. Now one of the most useful results of the lectures given before this society is to afford a basis for discussion afterwards, and if we here put forward one scheme of action, it is hoped that the criticism and alternatives brought forward in the discussion will correct it where wrong and amplify it where needed.

It appears that meteorology should be of service in two main ways: (I.) by providing necessary information regarding all weather conditions which are likely to be encountered on any journey; (II.) by providing statistical information which may be required to settle certain definite questions and by explaining the physical causes of various phenomena.

We may sub-divide this section into four parts, according to the information which is required by an aeroplane starting out on a long journey.

(1) Information regarding the probable wind which the aeroplane will encounter at any height at which it may fly along its route. This will be required both as an aid to navigation (almost essential if the flight be above clouds), and also for selecting the best height at which to fly.

(2) Information regarding the heights of the upper or lower limits of the various cloud layers, so that one may decide whether to fly above or below cloud.

(3) Ample warning must be given of any possibility of the clouds becoming so low as to touch the ground at any point along the route, or the formation of a ground fog.

(4) An indication of the general weather likely to be encountered along the route, with particular warning of any squalls, etc., which may be encountered.

As regards the second part of our subject, viz., providing sundry statistical information for the use of aviation, there is comparatively little to say. This problem is very much easier than the first, though, of course, somewhat dull except to those who immediately require the information. We have seen, for example, that we ought to know roughly the "probable" change of wind in any interval of time, and between two places any distance apart, for various parts of the earth's surface; also such information as the change of wind with height. In addition, of course, it is important to know the prevailing winds at any place where the winds are sufficiently regular to make the information valuable. Much of this information, especially that applying to the atmosphere near the ground, is already available, and the remainder can nearly always be obtained if it be considered of sufficient importance to spend the necessary amount of money in obtaining it—as, for example, by equipping the necessary kite-balloon stations.

When dealing with statistical information such as the prevailing winds at any place, one must remember that it is of comparatively little value to find the average or most frequent wind, unless we also know how often the wind departs from this value by any given amount. Thus, if we took the British Isles we should find the prevailing surface wind to be approximately S.W. and I suppose about 15 m.p.h.; this information, however, would be quite useless for aviation, as the chances that any given day has a wind very different from this are very large indeed. As another example we may take the distribution of pressure, temperature and density of the air, with height. This will show us, for example, how we should calibrate an aneroid to obtain the most accurate readings, but we require the standard deviations of these values to calculate how often errors of any magnitude will occur. (*Aeronautical Journal*, May, 1921.)

NAVAL and MILITARY AERONAUTICS

Generals Menoher and Mitchell Decorated

The Italian Ambassador, Senator Rolandi Ricci, conferred upon General Menoher, Chief of the Air Service, and General Mitchell, Assistant Chief of the Air Service, the Commenda of Saint Maurizio and Lazzaro by direction of His Majesty, the King of Italy, in recognition of the distinguished services rendered to Italian aeronautics.

The ceremony took place at the Italian Embassy and it was attended by Generals March, Wright, Haan, Jervey, Nolan, Col. Buckey of the Army Intelligence and Comm. Henderson of Naval Intelligence.

Many officers of the Air Service Staff were present together with all air and military attaches of the Allied powers.

General Mitchell's little girl and Mrs. Wright kindly assisted the personnel of the Embassy in receiving the guests.

First Provisional Air Brigade in Review

The inspection and review of the 1st Provisional Air Brigade of the United States Army, commanded by Brigadier General William Mitchell, was held at Langley Field June 11. In the absence of General Mitchell the brigade was commanded by Major Milling, a veteran army flyer, chief of staff to General Mitchell.

The planes were lined up on the field as follows:

In the first line were fifteen SE-5 pursuit planes equipped with bomb racks to carry four 25-pound Cooper bombs, two synchronized machine guns and radio telephone receiving and sending sets. These planes are used for attacking personnel on board ships and on the ground.

The next two lines consisted of thirty DH-4 light bombing planes equipped with bomb racks to carry either four 100-pound or two 300-pound high capacity bombs, two synchronized machine guns, operated by the pilot, and two fixed guns on movable mounts in the rear cockpit operated by the observer.

These planes are used for light bombardment, such as attack upon lightly armored ships, destruction of personnel and light construction on capital ships, destruction of buildings, ammunition dumps, and so forth, on the ground.

The last three lines consisted of twenty Martin Bombers, Handley Pages, Capronis and Eagles, all multi-motored, heavy bombardment planes. These are used for attacking armored capital ships, aeroplane carriers and so forth. They carry 300-pound, 600-pound, 1,100-pound and 2,000-pound bombs, each plane having a capacity of over 2,000 pounds of bombs in addition to its fuel and personnel. These planes also are equipped with five machine guns on fixed mounts in the front and rear cockpits, so located that they can protect themselves from hostile aircraft from every angle.

After the ground inspection by Major Milling the planes took off in successive formations of five small and three big planes, simulating an attack. These flights circled above the field several times, passing in review, and then landed in succession. The planes were handled with beautiful precision, and kept their positions perfectly while flying.

Previous to the review of the aeroplanes four army airships or "blimps" passed in review in fleet formation like a division of battleships.

General Mitchell has assembled 120 planes of various types here preparatory to the bombing test which will begin June 21.

The review was an impressive exhibition of the attack formation of an air force and a proof of the skill of the personnel of the army air service today, but it is plain that the air forces available in the event of war are pitifully small.

Loening PW-2 and Elias TA-1 Tested

On May 12, 1921, two new aeroplanes built for the Air Service were given their initial flights at McCook Field, Dayton, Ohio. The Loening PW-2, single seater pursuit aeroplane was flown by Lt. J. A. Macready, who reported that the aeroplane handled very well, was quite pleasant to fly and possessed excellent visibility. He experienced no difficulties on the flight, which lasted about half an hour, during which time he tried very thoroughly the various flying qualities of the aeroplane. The aeroplane is equipped with a 300 H. P. Wright engine with a four-bladed propeller and carries full military equipment for the single seater pursuit aeroplane developed during the war, being a monoplane with the wing attached to the upper longerons and braced by diagonal struts to the lower longerons of the fuselage.

The G. Elias TA-1 training aeroplane was flown by Lt. George B. Patterson who reported that the aeroplane balanced perfectly and seemed very light and responsive to the controls. It appears to land very slowly and stops after an unusually short run. The TA-1 is a two-seater training aeroplane equipped with the 170 Wasp ABC air-cooled radial engine. It is the first military aeroplane which has been flown with the U. S. A. 27 wing curve, which has given remarkable results in the wind tunnel tests. With this wing section only one part of struts on each side is required for bracing, which greatly simplifies rigging and maintenance in the field. With the exception of the strut arrangement the general design of the aeroplane follows orthodox practice.

Two-Man Altitude Flight

What is believed to be a new world's altitude record for pilot and passenger was made on May 6, 1921, by Lt. J. A. Macready with Roy S. Langham as observer, when he reached a corrected indicated altitude of 34,150 feet above sea level in a Lepere biplane equipped with a Moss supercharger. This aeroplane is the same one in which Major Schroeder made his world's altitude record, both for pilot alone and for pilot and passenger. The preliminary calibrations of the instrument and the computations were performed by the Flight Test Branch at McCook Field.

The instrument and data gathered on the flight will be forwarded to the Bureau of Standards for final checking before a world record is claimed. It will be remembered that on the occasion of Major Schroeder's altitude flight the Bureau of Standards computation of the results gave a figure more than a thousand feet higher than the preliminary computation performed at McCook Field. In view of this it is considered very probable that Lt. Macready has set a new record.

No difficulty was experienced by the pilot except the discomfort caused by the extreme cold at this high altitude and by the frosting of his goggles. Upon removing his glove in order to attempt to wipe ice from his goggles, his left hand became so stiff from cold that he lost the use of it until the warm air at low altitude restored the circulation. The engine and supercharger functioned very satisfactorily.

It should be noted that while the figure given above does not represent the true altitude above sea-level actually attained by the aeroplane, it does represent the figure upon which altitude records are granted. The corrected indicated altitude is dependent solely upon the pressure of the atmosphere in which the aeroplane is flying, and if two aeroplanes attain the same corrected altitude on different days, which of the two aeroplanes reaches a higher true altitude depends on the temperature existing in the atmosphere between the aeroplane and the ground, and which is, of course, a matter of luck. It is for the purpose of eliminating the element of luck that the International Aeronautic Federation disregards true altitude in determining records, since it is obvious that, if one aeroplane reaches a higher corrected indicated altitude than another (which means lower air pressure) it could out-climb the first aeroplane provided both were flown under identical atmospheric conditions. In order to obtain the correct indicated altitude, all the temperature and pressure corrections of the barograph used must be accurately known and carefully applied to the observed readings obtained on the flight. For this purpose elaborate temperature and pressure calibrating apparatus is required.

For purposes of comparison it will be remembered that Major Schroeder's corrected indicated altitude for the one-man record was 38,180 feet by the Bureau of Standards computation, and for the two-men record was 33,350 feet computed by the Flight Test Branch at McCook Field.

Reduction in Air Service Personnel

In compliance with the government policy of economy the Army Air Service has, progressively for over a year, reduced its civilian personnel so that by July 1, 1921, it will have reached an irreducible minimum.

The following table shows the strength of the civilian personnel of the Air Service on respective dates:

July 1, 1920	860
January 1, 1921	732
May 1, 1921	628
July 1, 1921	309

The last figures are made necessary by the L. E. J. Bill for the Fiscal Year ending June 30, 1922, which will provide about $350,000 for civilian personnel in the office of the Chief of Air Service as against $948,000 available a year ago.

FOREIGN NEWS

Compagnie Aerienne Francaise

This company held an ordinary meeting on March 10 to pass the first balance sheet, and an extraordinary meeting to decide on the increase of its capital. M. Ferdinand Gros, Chairman of the Board of Directors, presided. The company has carried out in detail the program drawn up at the time of its foundation—April 1, 1919. It has established branch organizations in the various districts which permit it to carry on all kinds of work connected with aviation throughout France. It now possesses about 40 aeroplanes, and has recently opened a school for training pilots; it also proposes to run an international air line. The balance sheet shows, after writing off, a net profit on the working, which the meeting decided to carry forward. M. Bernard de Courville was appointed a new director.

To Fly Across the Pacific

It is stated that Lieutenant Parer, the Australian airman, proposes to start on a flight round Australia this month, accompanied by an observer, a mechanic, and a cinematograph operator. His object is to raise money to buy a machine for an attempt to fly across the Pacific.

The Pegna Giant Seaplane

Experiments are proceeding with a large seaplane invented by Engineer Pegna, and manufactured at Bastianelli's workshops in Rome. With its daring cellule, its general construction, its power installation, its up-to-date shape, and high aerodynamical efficiency, this type marks a great step forward. It is able to lift five tons at 170 km. speed per hour, and is to be adopted by the Royal Italian Navy.

Swedish Naval Air Service

The Swedish Naval Administration have forwarded a report to the Crown stating that as no grants were given in 1919 and 1920 for procuring new flying-boats for the Naval Air Service, the present number is inadequate, both from the point of view of training and mobilization: some of the flying material is out of date, and certain flying-boats must be considered as unfit for use. Last year flying-boats were used for training purposes to a far greater degree than was considered desirable from the point of view of maintenance and mobilization. In addition, the Naval Administration submits measures for eliminating the difficulties connected with tests flights at the Stockholm Naval Dockyard. Some of these difficulties could be overcome by establishing a slipway and hangars at Hagernas. A sum of 60,000 kroner would be required for arranging a slipway and canvas hangars, and it is suggested that the work should be done by the unemployed.

German Air Traffic with Lithuania and Poland

The German air transport companies are making good use of the sad state of railroad and other transportation systems in the countries of their new Eastern neighbors. A German company is reported to have opened a regular service with Fokker passenger and freight planes between Danzig, Kovno, and Vilna and between Danzig and Warsaw. The first two of these Dutch planes arrived by air from the Fokker factor recently, one stop being made *en route,* at Warnemunde; each machine carries 1,200 pounds of freight, so the service should prove a useful connection for passengers and urgent supplies between the centres of Lithuania and Poland and the Baltic ports.

Handley Page Records

A summary of flights issued by Handley Page Transport, Ltd., shows that in nine weeks their aeroplanes covered 14,000 miles between London and Paris, and carried 505 passengers.

Amsterdam Service Doubled

Beginning last week, two air expresses instead of one were flown each way daily between London and Amsterdam.

The number of Continental air expresses in and out of the Croydon air station daily now reach 16.

New Airship for Japan

The Vickers-built airship recently completed for Japan has been deflated, and the whole structure taken down and packed for shipment to Japan, where the vessel will be reassembled for service in that country. She is of the sea-scout type.

Anglo-Franco-Belgian Air Conference

Meetings are now being held at the Air Ministry with the object of dealing with any questions which may arise in connection with the International Air Convention before its final ratification. Among the subjects which are being discussed are wireless telegraphy, meteorology, organization, navigation, night-flying, pilots' certificates, the Customs service, and the air-worthiness of machines. Such a programme is decidedly comprehensive, especially when one bears in mind that the airways have been operating for such a comparatively short time that very little real data is available. Of all these points we consider that organization and night-flying deserve the greatest amount of attention. As we have repeatedly pointed out, the organization of the airways is, in many cases, bad in the extreme. This particularly applies to the aerial posts. The actual flights between London and the various Continental destinations are invariably carried out extremely well, but this good work is often nulllified by the lack of understanding, or carelessness, on the part of those concerned with the ground organization. Night-flying must be developed before mail carrying can be as great a success as is possible. Whilst a large amount of time can be saved by carrying mails by day, their carriage by night, which would mean that letters for the Continent could be posted in London up to the normal hours for country delivery, would induce many more people to send their letters by air. In the same way passengers would greatly benefit by the introduction of night-flying, but this is impossible until efficient lighting of aerodromes and placing of lighthouses has been arranged, and the organization of the airways is complete in this respect.

Rotterdam-Dortmund Air Service

The Rotterdam correspondent of the *Times* states that an air service between Rotterdam and Dortmund, to facilitate communication with Southern Germany and Berlin, is to be opened within a fortnight.

Munich-Lake Constance Air Service

The daily air service between Munich (Schleissheim) and Lake Constance, opened by the Bavarian Luft-Lloyd, is run according to the following time-table:—

Munich (dep.): 7.30 a.m.
Constance (arr.): 9.25 a.m
Constance (dep.): 10.0 a.m.
Munich (arr.): 11.55 a.m.

The single fare is 400 marks per passenger, the return fare 800 marks. The German Post Office has announced that this service and the service between Berlin-Leipzig-Augsberg-Munich are open for the carriage of mails at the regular air mail fees.

Australian Air Service

In the Senate at Melbourne on April 22nd, Mr. Pearce, the Minister for Defence, during the debate on the second reading of the Air Force Bill, which provides for the creation of permanent air forces, said that 72 machines were at present on the establishment and 79 surplus machines were also held. The reserve, he said, should be 50 per cent. of the total establishment.

Vickers Airship for Japan

The first airship built for the Japanese Government was launched by Vickers April 28, says the *Times* of London, from their airship shed at Barrow. She is of the sea-scout class, carrying one gondola and a small crew. The ship made a satisfactory trial flight, carrying several Japanese officers. She is the only aircraft now on hand at the Walney aircraft factory.

Fresh Flowers by Air to England

Recently nearly a quarter of a ton of tulips cut in Holland, still wet with dew, were brought by aeroplane from Amsterdam to London and then sent by rail to Manchester where they were on sale in the morning market.

Aviation in Siam

Now that the discussion of the future of aeronautics is uppermost in the minds of those who concern themselves with national and international affairs, it is of interest to know that H. S. R. Major Prince Pridi, of Siam—cousin of the present King of that country—is in England for the purpose of gathering information to assist Siam in the formation of an Air Force.

During his stay he took the first opportunity of visiting the Napier factory at Acton, where the 450 h.p. Napier "Lion" aero engine is manufactured, as well as its big brother, the 1000 h.p. Napier "Cub."

Anglo-Dutch Air Service, with Connections to Copenhagen

Under the auspices of the Royal Dutch Air Service Company, Limited, a regular daily aeroplane service between London and Holland commenced operation on April 15, according to the *London Financier.* The London terminal is the Croydon aerodrome, and passengers leave Greener House, Haymarket—the West End offices of the company—by the service motor-cars, one hour before the departure of the aeroplane from Croydon. The machines are luxuriously equipped and comfortable armchairs are provided for the passengers.

Leaving the Haymarket at 9 A. M. and Croydon at 10 A. M., Rotterdam reached by 1:20 P. M. to land passengers, and the journey resumed at 1:35 P. M. for Amsterdam, the terminal, which is reached at 2:03 P. M. Aeroplane connection at Amsterdam is made for Paris, Brussels, Hamburg and, subsequently, Copenhagen.

The fare from London to Rotterdam or Amsterdam is 10 guineas; for goods 1s 3d per lb. The morning aeroplane from England to Holland connects with the afternoon train to Germany—and the night train from Germany connects with the afternoon aeroplane from Holland to England. The time-saving effected by this new service for passengers, goods and urgent business papers should ensure the success of the enterprise.

London-Moscow Route

The news from Paris, say the *Evening Mail* of London, April 14, that an air service has been commenced between that city and Warsaw adds yet another link to the network of airways now spreading over Europe.

Tomorrow the London-Amsterdam service, with extensions to Copenhagen and Berlin, will be inaugurated, and an air service between Paris and Amsterdam, via Brussels, will also commence.

Negotiations are now nearing completion for an airway from Berlin via Riga to Moscow, and when this service is running it will be possible to travel by air right through from London to Moscow, a distance of nearly 2,000 miles.

The existing London-Paris air service connects at Paris with the airway to Warsaw, which goes by the way of Strasbourg and Prague, while the Franco-Roumanian Air Service Company, who are responsible for this airway, have obtained connections from the Austrian and Roumanian Governments and hope shortly to open an airway that will connect London through Paris with Constantinople.

German Dailies by Air

One of the Berlin Dailies, the *Berliner Tageblatt,* has for some time past made arrangements for copies of its papers to be carried by the German-Dutch air mails. After leaving Berlin at 11 a. m., these copies are ready for delivery in Amsterdam at 5.30 p. m., and in Rotterdam at 6 p. m. In the case of transmission by rail, the papers would, of course, only reach their destination in time to be sold on the following morning.

Another service of the same kind has been organized on the Berlin-Dresden air mail line. The *Berliner Tageblatt* evening edition, after coming from the printers at 3 p. m., starts on board the aeroplane leaving Berlin at 3.30 p. m. and is sold in the streets of Dresden by 5.30 p. m.

An Italian Aeronautical Congress

Under the patronage of the Italian Aero Club and by initiative of the "Turin Aviation Society" and "Aviators' Association," an aeronautical national Congress was held in Turin from June 6-8.

The Congress comprised four sections, *viz:*

1. Machines and engines.
2. Miscellaneous applications.
3. Legislation.
4. General undertaking and organization.

ELEMENTARY AERONAUTICS *and* MODEL NOTES

Some Considerations on Model Contests

IN model contests, and more particularly in contests for records or awards, the fairest conditions restricting the model types are those placing the machines on an equal footing as judged by predetermined standards. When the results of contests are very close to other records, an actual comparison of all the conditions entering into the events might disclose that one model has made a much better flight than another which at first glance appeared to have been more successful. For example, two models might make a duration flight of, say, 120 seconds, but one of these machines may have had less power or less weight or less wing area, etc.

To make the contests more interesting and instructive it is well to have all the rules, regulations and limiting conditions fully understood and agreed to by the competing builders. As the framing and supervision of such rules entails some careful study on the part of the rules committees, it is seldom that rigid rules are drawn up previous to the running of a contest, but it would be worth a trial to see how closely the events can be made to conform to a set of rules previously agreed upon.

Methods of Comparison

The results of a contest can be judged, firstly, by the type of model, and secondly by the conditions existing when the flight takes place. Models are easily compared, one with another, but the second conditions, which are dependent upon the weather and other physical phenomena to which the models are subject, are judged fairly only by one whose opinion on the subject is rendered after due consideration is given to all the records made for that event. Before considering the model itself, there are rules that govern the entrants themselves; the contest may be an open contest, for all persons, or it may be restricted to certain clubs or groups of model flyers. In either case the first restriction may be on the subject of age. There are usually two classes formed; one for boys up to sixteen, and the other for boys over that age. Of course the club committees must decide upon the age limits, for this will vary with different groups of boys.

A contest generally allows the use of any type of model, rubber-driven or compressed-air driven, pusher or tractor, monoplane, biplane, etc., unless the rules clearly specify the particular types eligible. This, then, should be one of the first things to agree upon. If it is agreed, for instance, that rubber driven models only are eligible, let us consider how many variations there may be to the classifications it is possible to conform to.

Motive Power

One of the most usual restrictions is of the length of motor-frame. To be exact the frame members should be measured between the points where the hooks for the elastic are attached. A better and fairer restriction is to specify a certain total length of rubber elastic, or a certain weight of elastic, and allow the builder to arrange it in whatever way he thinks best. This allows the use of a long frame with a few strands of rubber or a short frame with more strands of rubber, although both machines would have the same number of feet of rubber elastic for their motive power.

Another restriction is to specify whether one or more propellers are to be used. It should be decided whether gear-driven models are eligible.

Wing Area

A good rule is to specify the area that each wing is permitted to have, for it then is left to the builder to dispose of the surface in the manner he believes most efficient. As the aspect ratio (the relation of the chord to the gap) has a great bearing on the lifting property of a wing, the specification of a certain total area leaves sufficient latitude for builders to choose a span-to-chord ratio suitable for their machines.

To limit the span of a wing, regardless of its area, is seldom productive of good results, and such a restriction is not recommended.

One of the most interesting, as well as the fairest comparison, is by weight as compared to area. That is to say, the models should be restricted to a certain number of ounces per square inch of supporting surface. As the efficiency of full-sized aeroplanes is judged by their weight in pounds per square foot of supporting surface, the application of such a standard to models would place them on a more nearly equal basis. This requires the employment of a very accurate scale with which to weigh the models, but such a scale would not be costly for a progressive club, and the accuracy with which models can be weighed to within a hundredth of an ounce of being correct should make for great progress in weight reduction.

The areas of the wing surfaces are easily measured by means of a small rule, and the areas at curved wing tips can be fairly well approximated.

Weather Conditions

When a record flight is made, the fairest way to judge the actual efficiency of the model is to make due allowances for wind. A model travels with the wind for a greater distance and for a greater length of time than one heading into the wind. This is due to the fact that an assisting wind helps to support the model and also retards or slows up the revolutions of the propeller. When the model heads into a wind, the propellers have less resistance to rotating and the rubber elastic is quickly unwound.

Record flights are often made when a model happens to strike a stiff breeze and judges should note the direction and approximate speed of the wind when rendering important decisions in closely contested events.

Altitude affects the flight of a model just as surely as a full sized plane is affected. In parts of the country located high above sea level, model flying is much more difficult than in cities along the coast. The effect is comparable to the buoyancy of fresh water and that of sea water—the density of the sea water makes a body more buoyant and in the case of an aeroplane or model, the density of the sea-level air is heavier and has more supporting power. The rarefication of mountain air necessitates the use of more wing area in order to obtain the same lifting effect as secured at sea level.

Method of Doping Wings

For the builder of a sport plane or glider, the following notes on correct method of applying and dopng fabric will be helpful.

When the fabric is cut to correct sizes, stretch it by hand, as evenly and tightly as possible, fastening it with small copper tacks at intervals along the ribs, etc. Linen tape should be laid all along where the tacks are to be driven, to prevent injury to the fabric.

Linen cord should be used to lace the fabric on the upper face of the wing to the under surface, making sure the cord is waxed before using with pure beeswax. The use of ordinary wax causes bubbles when the dope is applied.

Brush the first coat of dope well into the fabric, especially those parts coming in contact with the wood parts, in order to secure good penetration and adhesion. Flat brushes about five inches wide are best. The brushes should be perfectly clean and well saturated with dope and then wiped against the edge of the dope can before applying it to the fabric.

One hour or even two should elapse before applying a second coat, and after that is applied, allow a full hour between each remaining coat. Four coats should be used.

After the four coats have been applied, the doped parts should be allowed to stand over night so that complete drying and evaporation takes place, leaving the fabric perfectly taut.

Clear varnish in two very thin coats will be found to impart a good durable finish. Between each varnish application, twenty-four hours should be allowed for proper drying.

Rules and Regulations

By RUNSEN & TURNER

Please leave the gate open or apologize.

Those having no desire to fly should climb up on the plane, as we like to see your foot prints on the wings.

If you do not believe in signs stick a knife in the wings and you will see that it is not cast iron.

The tail is used to stabilize the plane and our lives depend on its accurate operation, but if you are tired, sit down on it, as it will help the plane "SHIMMY" if you pull it out of line. We always like to amuse our patrons.

Talk loud and whistle, especially when we are engaged. Foolish questions will be answered only when we are in a hurry.

Climb up on the wings, especially when we are just ready to fly, as the pilot needs your assistance or will appreciate any suggestions.

Walk up close to the motor while running and by sticking your hand in the propeller you will see that it really revolves.

Ladies with babies in arms will kindly use the wings for a cradle, as we know how tiresome it is. Then if a few holes are punched in the cloth what should we care. Linen is only three dollars per yard.

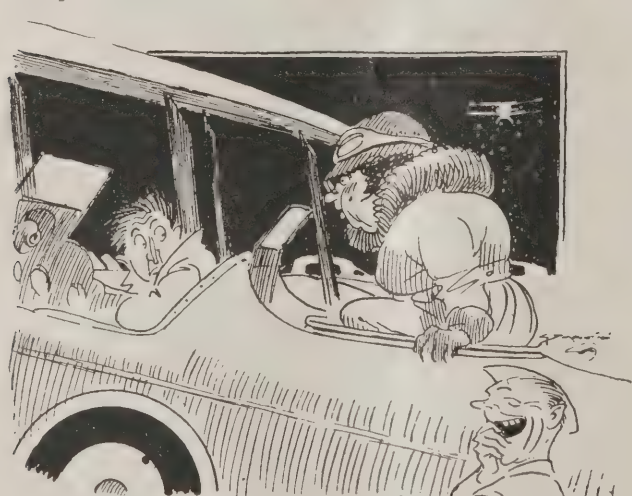
Should you desire a free flight, don't be bashful, ask us as we are always in need of fresh air and it only costs us one dollar per minute to operate. We have no expense, never get hungry and our gasoline costs us nothing, the aeroplane was given us to wear out and it is our desire to please everybody.

If you see any special tools that might make good toys for the kids or want any souvenirs, don't wait until dark to take them as we are always glad to remove anything from the plane as it has too many fittings anyway.

If you are crazy to fly, have no money or friends on the field, just give us a bad check as we are saving them for future use.

Don't ask the pilot to stunt you as the war is over; anyway we are not equipped with a shower bath.

When the pilot requests you to move back he is only kidding you. He can turn around and go the other way as you have as much right on the earth as he has and anyway this is a free country.



Gentlemen are requested to smoke when flying as a spark may illuminate the plane and give an added thrill to the spectators.

If you see us talking business, don't wait until we are through, but join in as we are particularly fond of speaking to half a dozen or more at a time.

When ladies climb in the plane, do not take advantage of the situation, there are lots of interesting things to look at on the plane to keep you busy until they are comfortably seated.

Profane language is at all times expected, especially if any ladies are present.

If we do not fly the plane, you tell us as we are willing to learn.

When we say, "Don't touch the controls", we are only kidding you. We want you to enjoy yourself while on the field and if a wire is disconnected and we fall, what's the difference, there are fifteen thousand aviators in America, and what's a mere aeroplane? There is more material and we can repair it if we escape injury.

"Mack," said Baker, with a reminiscent lick of his chops, "I was in a near-beer shop the other day and a fellow asked for a Manhattan cocktail."

"Did he get it?" queried Mack, with a longing expression in his eyes.

"No, the manhattant any."

The Ship and I

By CONTACT.

Those far below who see us fly,
See but a speck against the sky.
But I above see far and wide,
Borne on those magical wings as I ride.

Oh, to travel in God's open space,
Across the earth's shining face.
Over hill, valley and plain,
As we have flown again and again.

The "O. X." with its joyous song,
Carrying us swiftly, swiftly along.
And the "Jennie" in her steady flight,
Cleaving the winds for my delight.

Onward and upward, farther we flew,
Into the sea of fathomless blue.
To those below we were lost to sight.
Through winging our way at this great height.

'Tis time to go down. I spiral the bus.
Old Mother Earth jumps up to meet us.
Lower, yet lower we circle and drop,
We're nearing the end of a delightful "hop."

When I gaze up at the blue ways,
It makes me feel of the happy days.
That we spent in roaming the sky,
What times we had—the Ship and I!

The ebony-colored youth was before the Navy recruiting officer for examination.

"Have you any previous military experience?" he was asked.

"Lawd, yes, boss! Ah was shot at three times way 'fo' de war."

Overheard in the electrical gang:
"Is Amp ere?"
"No, 'e went ohm."
"Watt hour did 'e go ohm?"
"Did you see Circuit Breaker back?"
"Yes, she tripped."
"Wasn't that revolting?"—*The Sea Bag.*

F BOAT FOR SALE

COMPLETE WITHOUT MOTOR—HULL JUST REBUILT WING PANELS EXCELLENT SHAPE

PRICE $850.00 f.o.b. Pine Valley, N. J.
F Boat Spare Parts on hand for immediate delivery.
CURTISS EASTERN AIRPLANE CORP.
130 S. Fifteenth St., Philadelphia, Pa.

STONE MANUFACTURING CO., Inc.
Supreme Propellers

For immediate delivery

Future Location, 2623 Olive St., ST. LOUIS, MO.
Pioneer Propeller Builders **Established 1910**

Students of Aviation, Model Builders and Experimenters

The Wading River Model Airplane & Supply Co., as the oldest establishment of this kind in the U. S., is able to supply you with the best material at the most reasonable prices.

Scale Drawings and Blueprints of some of the latest types always on hand.

We also make models to your own plans at reasonable prices. Send $.05 for Illustrated Catalog.

WADING RIVER MFG. CO., 672 Broadway, Brooklyn, N. Y.

REDUCTIONS IN
NEW CANUCK & OX-5 ENGINE SPARE PARTS

New Rome Turney Rads. $23—C. A. L. & Paragon Props $20, etc.
Also a complete assortment of
3½% nickel steel bolts, screws, clevis pins, eyebolts, nuts, ferrules, thimbles, turnbuckles, wire and cable.
Write for our 1921 price list.

AIRCRAFT MATERIALS AND EQUIPMENT CORP.
1407-9 Sedgwick Ave. **New York City**

AVIATION
FLYING AND GROUND SCHOOL

COURSES TAKEN SEPARATELY OR COMBINED

We have the very best of flying instructors. Our ground instructors will teach you motors from A-Z and show you how to build an airplane from the ground up.

We specialize on MOTOR MECHANICS and RIGGERS

and can turn you out qualified to handle such position paying from $200 to $300 monthly.

Write for descriptive literature.

OBERLIN AERIAL SERVICE
Oberlin, Ohio

READY TO STUNT!

Before leaving with the Ruth Law Flying Circus Lieut. Verne Treat put our Canucks through the most exhaustive acrobatic tests. You may not want to stunt but you can rest assured that your *De Luxe* plane is tuned to the highest pitch of efficiency.

SPECIAL THIS WEEK!

New Canuck, painted in light blue and ivory, rebuilt OX5 motor. Assortment of $300 worth of spares, including wing........$2500

E LUXE AIR SERVICE, Inc.
Asbury Park, N. J.

New OX-5 Curtiss Motors

We have available for immediate delivery a few OX-5 Curtiss, Hammondsport Production Motors, complete with tools and packed in water proof cases.

ESCH & HAMMOND, Distributors of the Laird "Swallow"
2216 So. Michigan Avenue, Chicago, Ill.

Advertising in this department 10c a word $2.00 minimum

Classified Advertising

Forms close for this department on Monday preceding date of issue

---

PATENTS **Ex-Pilot U. S. Air Service**
ALLEN E. PECK
Patent Attorney
Pacific Bldg., Washington, D. C.

FOR SALE—Aerial Graflex camera. Not the ordinary kind. For full particulars write the Venard Film Corp., Orpheum Theatre Bldg., Peoria, Ill.

THREE PASSENGER PLANE with OX motor, new. Will sacrifice at less than market price. Write Box 595, c/o AERIAL AGE WEEKLY, 280 Madison Ave., New York City.

FOR SALE—JN4D2 two pasenger Curtiss biplane. We also have girl parachute jumper with outfit and prospective contracts. Address Hungerford Bros., 823 W. Second St., Elmira, N. Y.

EIGHT OR NINE CANUCKS in good condition, for sale. Prices from $1800 up. Reasonable terms to responsible parties. Address John P. Porter, Service Aviation Co., Wabash, Ind.

FOR SALE—American Curtiss newly covered in A1 flying condition. Ready to fly away $2500.00. Address Henry H. Tallman, 6 Marshall Ave., Ridgewood, N. J.

WE ARE EXPERTS on all aeroplane motor troubles, all types. Experienced men sent anywhere at any time. Wire or write to Wright & Corson, 2701 Diamond St., Philadelphia, Pa.

FOR SALE—Canuck in good condition, just painted, set up ready to fly away. Price $1400.00. Address Box 597, c/o AERIAL AGE WEEKLY, 280 Madison Ave., New York City.

FIVE PILOTS WANTED with own planes to join flying circus booked through the middle west about June fifteenth. Will be booked solid. Wire or write The Glenn E. Messer Company, Fort Madison, Iowa.

AMERICAN CURTISS in good condition. Fabric medium, motor fine. $1000.00 including spares, tools, extra tires, etc. Address R. H. Beaumont, Radner, Delaware County, Pa.

FOR SALE, Practically new JN4D. Have genuine Hammondsport Curtiss OX5 motor in perfect condition, cheap. Roy Innes, Sutherland, Ia.

FOR SALE—New Liberty motor parts, reasonable price, immediate shipment. Also brand new Curtiss OX5 cylinders. Never uncrated. Address Grant Motor Co., 912 E. Grand Blvd., Detroit, Mich.

A LIMITED NUMBER AT $200. Lawrence motors 30/40 H.P. weighs 128 lbs. complete, new in crate. Plans and installation blueprints of monoplane free. Address Bordelon, 108 Trolleyway, Venice, Cal.

FOR SALE—Two Canadian Curtiss planes with OX5 motors. Completely overhauled and refinished; look like new. Also large stock of parts and accessories. No reasonable offer refused. Address Lee J. Myers, Akron, Ohio.

PARACHUTES FOR AVIATORS—Emergency and exhibition purposes; standard equipment. State weight, rope ladders for plane changing. Established in 1903. Thompson Bros. Balloon Co., Aurora, Ill.

CANUCK AND OX5 PARTS at big discounts, unlimited supply C.A.L. propellers at $20. Other bargains. Specify your wants. Address Chas. H. Paterson, 6504 South State St., Chicago, Ill.

CURTISS SEAGULL FLYING BOAT, K-6 motor, late model, 3 passenger, one Dep and one stick control. Used about 50 hours. For sale cheap. Complete with winch, storage shed and tent hangar. Located on Chautauqua Lake, New York; six miles from Lake Erie. Could be flown to good profit at surrounding summer resorts. Address J. W. Packard, Lakewood, New York.

FOR SALE—New four-passenger flying boat, 38 foot spread, mahogany hull, Curtiss OXX6 motor. For further particulars address Herbert Wacker, 1449 Montclair Ave., Detroit, Mich.

SPECIAL FOR QUICK SALE — Canuck Curtiss, new linens, new finish throughout, new 90 H.P. OX5 motor, ready to fly. We guarantee quality and performance, $2000.00. The above complete less motor, $1000.00. Address Haug's Independent Airplane Company, 1007 F. & M. Building, Ft. Worth, Texas.

F BOAT PILOT WANTED at once. Apply to F. R. Golder, Aeroplane Hangar, Ft. Washington, L. I.

AERIAL COMPANIES ATTENTION. First class aviator desires to get into the game again. 500 hrs. 16 types, commercial pilot and experience. Instructor of Gosport System, Captain in C. A. F. Best references. Any flying proposition, anywhere, any type. For further particulars communicate with Box 511, Stettler, Alta, Canada.

YOUNG MAN, college six years mechanical drafting; desires connection with aeronautical company acting in any capacity. Address Martin, 190 80th St., Brooklyn, N. Y.

PHOTOGRAPHS—Aeroplane wrecks. Scenes include Collisions, bad landings, crashes, etc., of Army planes. Clear, sharp pictures and interesting. Size 5 x 7. $1.00 a set. Address Wm. J. Lynch, 5206 Bishop St., Chicago, Ill.

FOR SALE—Curtiss Oriole with K6 motor, 30 hours flying. Curtiss JN4D 60 hours flying. Both ships in good shape. Also JN4D fuselage complete with motor, landing gear, etc. Address Overland Columbia Co., Columbia, S. C.

FOR SALE—Radiator, honeycomb type 18x 30x4 inches with 6 in. propeller hole, $25.00. One experimental single seater tractor biplane without motor or wheels, $200.00. Address Box 596, c/o AERIAL AGE WEEKLY, 280 Madison Ave., New York City.

FOR SALE—Three place Avro with brand new motor, everything perfect. Price $3500. $2000 cash, balance six months. Reason for selling, getting large limousine. Address Runser & Turner, Columbia, S. C.

(*Concluded from page* 342)

regulation of air navigation and for other purposes; (M.A.)

April 25—House.

Mr. Oliver in Naval Appropriation Bill (H.R. 4803), emphasizes need of providing for aircraft carriers.

April 26—House.

Remarks on appropriations for naval aviation; (H.R. 4803).

Hicks (H.R. 5219), to create bureau of aeronautics in Dept. of the Navy; (N.A.) Reported back (H. Rept. 35.)

April 29—House.

Mr. Kahn advises House of Japan's aerial armament.

April 30—House.

Army Appropriation Bill (H.R. 5010). Appropriations for air service discussed. Revised expenditures of air service during war as prepared by Major L. D. Gardner is inserted in record.

May 5—House.

Britten (H.R. 5826), authorizing construction of aeroplane carriers for Naval establishment of the U. S. and revoking authority for construction of certain other vessels; (N.A.)

Hicks (H.R. 5833), authorizing construction of aeroplane carrier for Navy of U. S.; (N.A.)

May 6—Senate.

Emergency Tariff Bill (H.R. 2435). Mr. New submitted amendment to provide against dumping of aeroplanes in U. S.

May 9—Senate.

General Fries' memorandum on use of poisonous gases inserted in record.

Emergency Tariff Bill (H.R. 2435). Mr. Simmons mentions dumping of aeroplanes in connection with dumping of surplus war material in U. S.

May 11—Senate.

Emergency Tariff Bill (H.R. 2435), aircraft amendment of New lost through vigorous attack of Penrose.

May 12—Senate.

Naval Appropriations Bill (H.R. 4803). Amendment regarding naval aviation all agreed to. 1. Approp. of $1,440,000 for dirigible; 2. Approp. of $6,500,000 for aircraft factory, helium plant, air station, overhaul of planes, etc.; 3. Approp. of $3,000,000 for experimental work; 4. Approp. of $1,339,000 for air station; 5. Amendment to change approp. from $6,-913,431 to $18,729,000; 6. Provide for settlement of damages up to $500; 7. Approp. of $2,500,000 for hangar at Camp Kearny.

Mr. Dial had an article written by H. L. Scaife in *Current History Magazine* showing waste in aircraft production during war inserted in record.

May 13—Senate.

Mr. Kenyon draws attention to excess amounts asked for naval aviation in comparison with air service, whereas it is one-third as large.

May 14—Senate.

Amendment for approp. $26,000,000 for aeroplane carriers. Introduced by Borah. Passed over.

Amendment providing for Bureau of Aeronautics in Navy. Passed over.

May 16—Senate.

Mr. Promerene feels that pprop. for Navy should wait until outcome of tests between aeroplanes and battleships.

May 18—Senate.

Navy approp. (H.R. 4603). Amendment providing $26,000,000 for aeroplane carrier and authorization for 12 destroyers heretofore granted being revoked. Agreed to after discussion on possibility of unification of army, navy and post office as it would affect such an approp.

Hicks (H.R. 6297), authorizing construction of aeroplane carrier for U. S. N.; (N.A.)

May 21—House.

Mr. Grear introduced into record letter from Secretary of War regarding cancellation of war contracts and consequent saving of money. Vindication of his work in connection with a committee to investigate aviation expenditures.

May 23—Senate.

Three amendments to Naval Aviation Bill (H.R. 4603) by Mr. La Follette providing for personnel of Bureau of Aeronautics in Navy Dept. should have flying officers in charge. Laid on table.

Laid on table again May 24.

Agreed to May 25.

Naval appropriation (H.R. 4603) amendment to provide for air station at Camp Kearny, Cal. Agreed to.

May 24—Senate.

Navy Bill (H.R. 4603) amendment to establish a Bureau of Aeronautics in Navy. Passed over.

May 31—Senate.

Amendment by Mr. Lenroot to decrease approp. of $53,000,000 to $38,000,000 for aeroplane carriers. $16,000,000 being already approp. in Navy bill towards the construction of these carriers. Each carrier to cost $26,000,000. Rejected.

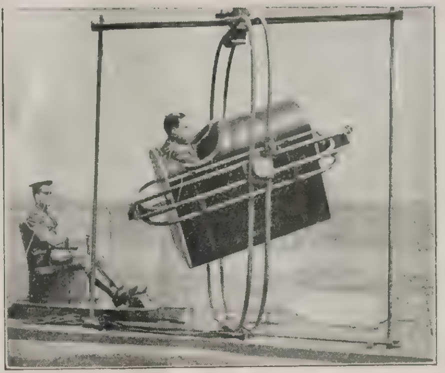
June 2—House.

Deficiency appropriations (H.R. 6300), postal service. Transcontinental mail service between N. Y. and San Francisco, $125,000. Agreed to.

June 3—House.

Deficiency appropriations (H.R. 6300), postal service. Settlement of damages not to exceed $500. Provided for. Agreed to.

Aeroplane stabilizer. Letter introduced into House by Rep. S. Merritt of Conn. regarding a aeroplane stabilizer perfected by Christopher J. Lake. Letter sent through Aeronautical Society of America.



(*Concluded from page* 349)

The use of a steam turbine instead of the gas turbine might be considered. The heat of the exhaust gases would be sufficient in this case also. But a suitable boiler and condenser are lacking. The aeroplane supercharger is a child of the war. It was born of the urgent need of continually raising the ceiling of the aeropalnes higher and ever higher, and of the necessity of using ordinary aeroplane engines in so doing. These two conditions are largely removed in peace time. For peacetime flying altitudes of from 3 to 4 km. will suffice, and for these altitudes the super-compression and super-dimension engine is sufficient. There may, however, be a notable future for the blower or supercharger with or without exhaust turbine for large engines ** in giant aeroplanes. We might also plan for the future a very large seaplane with a tremendous speed, which will fly at great altitudes for the purpose of utilizing the diminished air resistance at such heights. With such a seaplane the pilot and the engines would be in an airtight compartment in which the air would be maintained at about ground level pressure. These aeroplanes would be able to fly at altitudes of about 10 to 12 km. and attain a speed of 250 km/hr. and over, so that they would be able to make the trip from Germany to America in less than a day.

Summary

Aeroplane superchargers and problems connected therewith are discussed: Decrease of the density of the air with increasing altitude, causes of the decrease in engine power with increasing altitude, devices for maintaining costant engine power, super-compression and super-dimension engines, the aeroplane supercharger, drive and control of the supercharger, the overloading capacity of the engine by means of the supercharger, the pressure compensations at the carburetor, and fuel systems. Various superchargers constructed by Schwade, in Erfurt; Brown, Boveri & Co., in Mannheim; the A.E.G. in Hennigsdorf; and the Siemens Schuckert Werke in Siemenstadt are discussed, as are also the airscrews with fixed pitch, airscrews with variable pitch, by Prof. Reissner, and closing with a consideration of the technical aviation problems, plans, and prospects.

** German Reich's patent No. 204630 (A. Büchi) "Zeitschrift für das ges, Turbinenwessen," 1909, p. 313.

(*Concluded from page* 339)

else. What is more, now—in peace—is the time to learn what's new in warfare. If our ships are vulnerable it is better that we, and not an enemy, demonstrate the fact.—[*Editorial in N. Y. Herald.*]

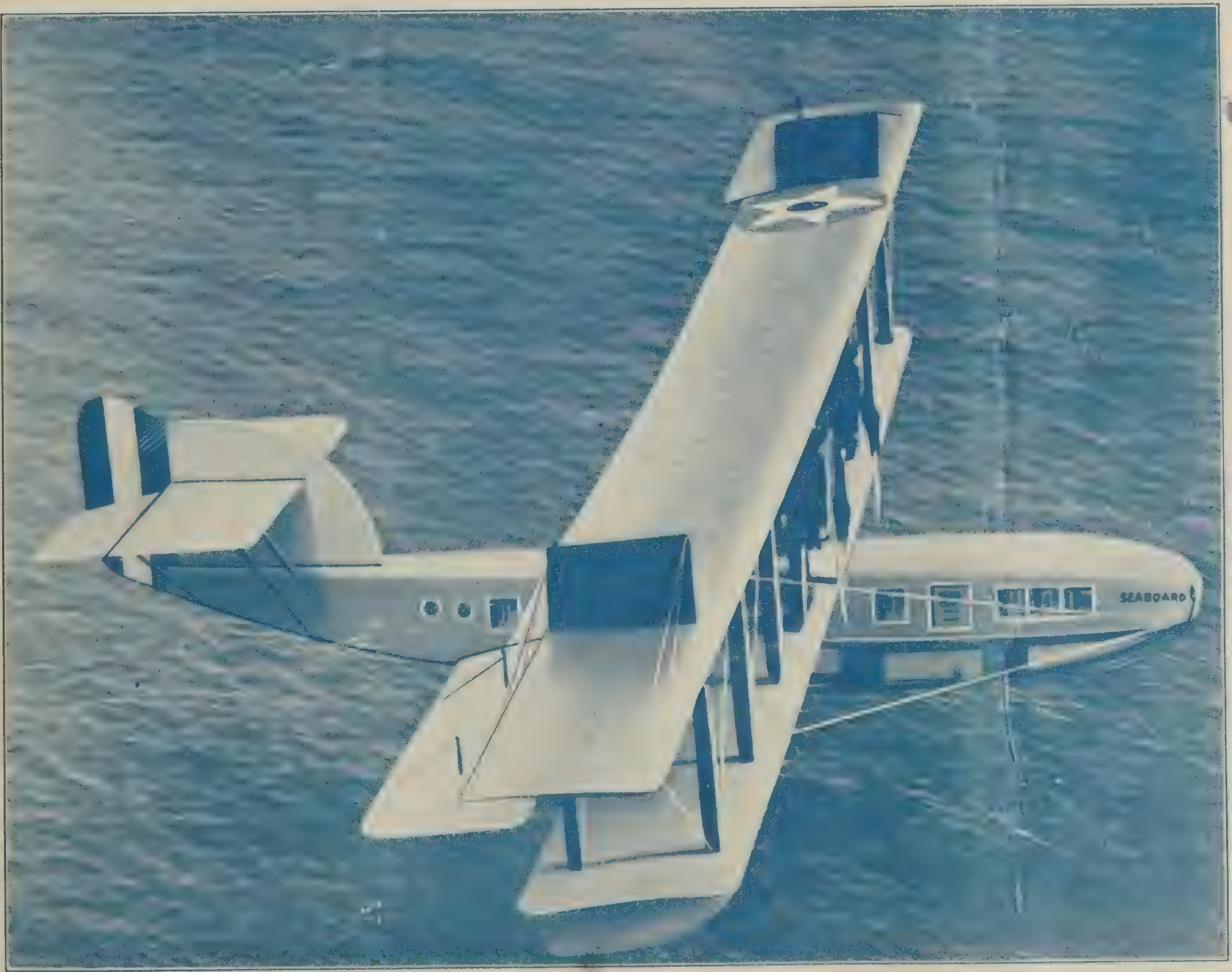
IT is to be regretted that Major General Charles T. Menoher, Chief of the Army Air Service, has asked Secretary Weeks to relieve Brigadier General William Mitchell, the Assistant Chief. Both these officers had excellent records in France and have been invaluable to army aviation. General Menoher is a good organizer and his interest in aviation is equaled only by his assistant's zeal. The superior officer has made many flights. General Mitchell commanded the Air Service in France, and although 40 years of age is still one of the best pilots in the army. His example is worth much to the service. The younger officers have a high regard for him as a leader. General Mitchell is the author of a book, "Our Air Force," a careful study of the value of the aeroplane in modern warfare. He has been detailed to take charge of the army bombing tests in the latter part of June.

General Mitchell no doubt has the defects of his qualities. He is full of energy and very sure of himself; a brilliant, active, positive, outspoken officer, who is quick to take the initiative and assume responsibility. He has urged a unified air service in and out of season, although he knows that his superior is opposed to it. General Mitchell holds decided views about the vulnerability of the battleship to the bombing aeroplane, and at a hearing by a Congressional committee provoked criticism by not hesitating to differ with the naval officers. There is a great deal of opposition in both services to the proposal of a single air bureau, and as General Mitchell is its most vigorous advocate he is regarded with disfavor in some quarters. Even Secretary Weeks, who is trying to compose the differences between the Chief and his assistant, admits that General Mitchell is not always tactful.

It is evident that General Menoher's request must be complied with unless he is persuaded to withdraw it. There is no officer in the army who more values efficiency and courage in subordinates. He has given proof of this on several occasions by recommending for promotion officers who have distinguished themselves. He must be well aware of the merits of his virile assistant. It is to be hoped that Secretary Weeks will succeed in persuading General Menoher to change his mind.—[*Editorial in N. Y. Times.*]

AERIAL AGE WEEKLY

OL. 13, No. 16 | JUNE 27, 1921 | 10 CENTS A COPY



Aerial Cruiser of the Seaboard Consolidated Airlines, Inc.

First Bombing Event Victory for Aeronautics

LISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
scriptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, *at the Post Office at New York, N. Y., under the Act of March* 3, 1879.

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIII — NEW YORK, JUNE 27, 1921 — NO. 16

SENATE MAY INVESTIGATE AERONAUTIC SITUATION

PORTENTS of a Senate inquiry into conditions in the air services and air agencies of the government were seen in a resolution which was offered in the Senate by Senator Borah.

The resolution, which is understood to be only a forerunner of other things to follow, provides for abolishing the National Advisory Committee for Aeronautics and transferring its property and duties to existing governmental agencies. It was referred to the Senate Military Affairs Committee, of which Senator Wadsworth is chairman, and is said to have strong support in that committee.

Back of the resolution is a purpose, it is asserted, to bring about a unified air service of the government, in accordance with the ideas of General William Mitchell, assistant director of the army air service.

Further than this the measure is indicative of the fact that there is keen Senate interest in what is going on with respect to the government's air services and in the tests of the effect on warships of aerial bombing. Senators are watching plans for these tests closely and some of them intimate a belief that Navy officials, opposed to development of air facilities, have shaped the rules for the test in such a fashion as to make it almost impracticable for the army planes or even navy planes to show what they can do.

In this relation, there is talk that by putting the warships, which are to be targets, about sixty miles outside the Virginia Capes it will be difficult for the army planes to go out and return without any chance to alight until they have traveled 120 miles and more.

The Borah resolution and the bombing tests have no connection on the face, but it can be said that Senator Borah and other Senators who are well disposed toward unifying the air service are watching the bombing developments keenly. The charge made as to the National Advisory Committee for Aeronautics is that it is controlled by civilians and army and navy men who are not abreast of aerial developments or progressive aerial policies. One of the members is Major-General Charles T. Menoher, who is at odds with General Mitchell. Another is Rear Admiral D. W. Taylor, of the Navy.

The Borah resolution holds that "the necessity for economy demands a consolidation, where possible, of governmental agencies whose authorities are overlapping and whose duties result in duplication." In proposing the abolishment of the National Advisory Committee it is planned by the resolution to transfer the technical duties of the committee to the Bureau of Standards, Department of Commerce, and the technical equipment also is transferred to the Bureau of Standards.

The buildings and real estate of the committee, at present of military and naval reservations, are transferred to the War Department or the Navy Department, as the case may be.

Such duties of the committee as relate to its advisory capacity on aeronautics are transferred to the War Council, as created by the national defense act of June 3, 1916, and amended by later acts.

First Bombing Event Victory for Aeronautics

Within sixteen minutes after the first division of naval seaplanes had attacked the former German submarine U-117 in the first event of the bombing tests at Norfolk, it was resting on the bottom of the Atlantic, fifty miles from the Virginia Capes. A direct hit with a 163-pound bomb did the work. Only three naval planes had a chance to attack.

The direct hit abruptly terminated the first of a series of experiments by the army and navy to test the ability of naval vessels to withstand damage inflicted from the air.

The bomb that settled the fate of the U-117 was one of a salvo of nine dropped from three planes that constituted the first and only aerial division to engage in the actual attack. A few minutes before the fatal salvo was fired the same division had dropped three bombs to get the range. The projectiles were hurled from a height of about 1,100 feet while the planes were making more than 100 miles an hour. It was only six minutes after the second salvo was launched that the U-117 made its last "crash dive" to find a resting place fifty fathoms deep.

The sinking in so short a time came as a surprise to most of the army and navy officers who witnessed the experiment, many of whom had been frankly skeptical regarding the ability of the planes even to hit the submarine, regardless of the fact that all the conditions favored the attacking forces and no effort was made to simulate actual war conditions. The U-117 was securely anchored and the bombing planes were given charts showing the exact position of the target. The bombing attack on the moving target is being awaited with great interest.

The News of the Week

Roosevelt Urges Federal Air Policy

A national aviation policy, not only for military purposes but also for mercantile air development, is emphatically advocated by Theodore Roosevelt, Assistant Secretary of the Navy, in an article in the current issue of the *Outlook.*

"In all new departures, such as aeronautics, activities tend to be ill considered," he says. "In order to avoid this we must as a first step establish a consistent Governmental air policy. If we do not do this we are certain to run into trouble; development will be haphazard and wasteful. We consider but one aspect of a given question, and as a result the ultimate action will often serve but one purpose, where it might have served two or more."

The closest of cooperation should exist between the mercantile and military air policies, since the one becomes part of the other in time of war. He recommends a comprehensive system of national air highways, weather reports, fog signals, beacons and Government and State-owned landing fields.

"Another most important step that should be taken immediately is the codification and formulation of a comprehensive code of air laws. At the present time there is little if anything along this line. This is essentially a Federal duty, for aircraft move so fast that the most of its work will be interstate. The need for these laws has been felt already. At the present moment many States have under consideration and some have already passed regulatory statutes. Should this continue an almost unravelled tangle will occur which will seriously impede development."

He recommends bureaus of aeronautics within the departments of Navy and War, with coordination between these and other Governmental air activities.

Airport Urged for Newport

Capt. Hugh L. Willoughby recently appeared before the Chamber of Commerce of Newport, R. I., and urged the necessity of the city establishing a Municipal airport. King Park was suggested as the best location. The matter is now receiving consideration.

The Aerial Mail Service

For the first time in its history, the Air Mail Service last week had 100 per cent. performance on all divisions, including the trans-continental route from New York to San Francisco. Second Assistant Postmaster General Shaughnessy has sent out a bulletin of congratulations to all the field forces for this splendid showing.

Changes in the Air Mail Service, which become effective July 1, involve the discontinuance of the route from Chicago to Minneapolis, and the route from Chicago to St. Louis. The aviation fields at College Park, Maryland, Bustleton, Pennsylvania, Newark, New Jersey, St. Louis, Missouri, Minneapolis, Minnesota, and LaCrosse, Wisconsin, will be abandoned shortly after July 1.

The trans-continental route from New York to San Francisco will be continued as usual under appropriation made by Congress. It has been necessary to abandon the lateral routes because Congress has not appropriated any money for the operation of these routes during the next year. The aviators and other men on these discontinued routes will be transferred to the trans-continental route and as far as possible utilized on regular work or on the reserve list. The equipment will also be utilized in this manner.

Aircraft Owners of Pennsylvania

The assistance of the Aero Club of Pennsylvania has been requested by the Adjutant General of the Pennsylvania National Guard, also by Major A. L. Sneed, of the Third Corps Area, Fort Howard, Maryland, in compiling a complete list of aircraft (lighter than air and heavier than air) privately owned within the State of Pennsylvania.

All owners of aircraft, both planes and balloons, are requested to assist in compiling this list and are requested to send their name, address and full particulars. Prompt response will be greatly appreciated and will undoubtedly bring news of much interest in return. Address all communications to W. H. Sheahan, 1st Vice President, Aero Club of Pennsylvania, Carol Boulevard, Highland Park, Upper Darby, Pa.

Low Parachute Record

What is regarded as a world's record for low altitude leap from an aeroplane in flight was established at El Reno, Okla., on May 28, by Frederick Lemon of Oklahoma City when he landed safely from a height of 125 feet. The former record was 175 feet.

A number of Army officers from Post Field witnessed the test made by Mr. Lemon, who used a new automatic opening parachute of his own invention. B. H. Griffen piloted the Lincoln Standard machine from which the descent was made.

The Late Donald Campbell

Donald Campbell, vice president and manager of the Hudson Valley Airline, Inc., and his mechanic, George Beattie, lost their lives in a flying boat accident on the Hudson River, near Troy, on June 19.

Campbell was a native of Illinois. At the outbreak of the world war he enlisted in the aviation section of the Signal Corps and was later an instructor at Kelly Field, Texas. His official air record credits him with 1,728 hours in the air.

The fatal crash was the first accident of any kind he ever had. He is survived by a widow and infant daughter.

Red Oak Aero Meet

The Red Oak Aero Club under the management of C. E. Tuttle will put on a three days Aero Meet and Show during June 23, 24 and 25.

This meet and show will be open to all manufacturers of aeroplanes and privately owned planes, pilots and acrobatic fliers. This is the first aero meet and show ever held in Iowa and will be conducted in true "Iowa Style."

Free gasoline, free oil and free hotel accommodations will be supplied to visiting pilots.

Goliath Wins French Grand Prize

The Farman Goliath on June 19 won the Grand Prix of the Aero Club of France, amounting to 100,000 francs, by flying over the 1,500-mile course prescribed for the event. All other entries had been withdrawn or the entrants had abandoned the contest.

The Goliath was manned by Lieutenant Bossoutrot, who used the machine in his Paris-Dakaar flight, and Ferdinand d'Or. The plane left Paris at 9:55 o'clock, June 18, and completed without incident the round trips to Lille, Pau and Metz, prescribed for the contest, reaching Paris from Metz at 10 p. m., June 19.

Besides its pilots the Goliath carried six eighty-kilo sand bags, representing passengers.

Pilot Andy Andrew, Father Ricard, San Francisco "Weather Man" and Walter T. Varney and the San Francisco "Call" aeroplane, used for reportorial work

Successful Aviette Test

Gabriel Poulain, former cycling champion of France, succeeded, June 18, in the Bois de Boulogne, in "flying" twenty feet along the ground at a height of eighteen inches in his motorless aviette. The only power employed was that of his own legs, and five times he succeeded in making a hop.

Although Poulain has "flown" further than any one else employing this method of propulsion, he has yet to win the Peugeot prize of 10,000 francs which has been offered for any one who can fly a distance of ten meters in a man-driven machine.

His attempt was made at 5 o'clock this morning along one of the quiet roads of the Bois in the presence of a number of official controllers belonging to the Aero Club and of some newspaper men. His machine is an ordinary bicycle with two planes, one above the other, giving a surface of about fifteen square meters. With the planes set level, Poulain pedaled hard along the road till he had reached a pace of about forty kilometers an hour. Then he altered the angle of the planes with a patent arrangement of his own, and the front wheel immediately rose from the ground to about sixteen inches. The rear wheel also rose, though not so high, and the machine traveled through the air for about eighteen feet at a gradually declining speed.

It was at the fourth attempt that the machine made its best showing. Poulain pedaled down hill at a pace of 48 kilometers. When he threw in his plane-changing gear the aviette sprang into the air and traveled without contact with the ground for two and three-fifths seconds, covering a distance of 8 meters.

Those who watched the trials believe that Poulain, with a slight alteration in the angle of the planes, will succeed in covering 10 meters and win the prize for which he has been trying so assiduously.

The Glenn Martin Field

The Glen L. Martin Field is located on the New York, Chicago & St. Louis Railway, 9½ miles northeastward of the main entrance to Cleveland Harbor (Cuyahoga River) and 1 mile southward of Euclid Beach Amusement Park, in ((approx.) latitude 41° 34′ N., longitude 81° 33′ W.

This field is L-shaped, extending 1,500 feet northwest and southeast and 1,900 feet northeast and southwest, prevailing wind west, weather conditions and wind directions reported upon request. Factory facilities and aeroplane service are available.

Colemanite Survey from Air

Representing a number of New York capitalists and bankers who are planning to finance the operation and development of the immense borax deposits recently discovered by Clark County, Nevada, prospectors, Dr. E. E. Free, famous consulting chemist of New York City, arrived Wednesday in Las Vegas on his way to the mine.

Dr. Free made the trip from Los Angeles to Las Vegas in a plane from the Mercury Aviation Company's field in a little over four hours' flying time. They made only two stops, one at Yermo and one at Kelso, for "gas."

After luncheon here they proceeded to the mine in the plane, making the trip in 31 minutes.

Major Luckhardt, who is in charge of the development work at the mine, stated that the trip could be made in at least 25 minutes, as they had circled over the deposit several times to allow the photographers to take pictures of the formations as shown from the air.

Battleships Dropped in French Naval Plan

Paris—In presenting France's naval construction programme for the next three years Deputy Paul Denise, chairman of the Navy Commission, advocated the virtual abandonment of the building of battleships and battle cruisers and intensification of construction of submarines, torpedo boats, destroyers and aeroplane carrying ships.

M. Denine pointed out that France as a pacific nation needed a navy for coast defence, not warships for offensive action.

The Gordon Bennett Balloon Entries

The following countries have already entered for the Gordon Bennett Balloon Race, which will be held this year in Belgium: —

	Entries
French Aero Club	3
United States Aero Club	3
British Aero Club	3
Italian Aero Club	3
Spanish Aero Club	1
Swiss Aero Club	1
Belgian Aero Club	3

The proposed date of the contest is September 18.

Aeronautics in the California Legislature

During the recent session of the California legislature three bills pertaining to aeronautics were passed.

The first was in the nature of an Assembly Joint Resolution relative to the use of aeroplanes in forest fire protection, which urged the federal representatives and senators from California to use their best endeavors to secure approval of the recommendations for the Air Service Patrol of Forests during the fire season of 1921.

The second bill concerned the registration, numbering and use of aircraft and the licensing of operators. According to this bill it will be necessary for every owner of an aeroplane to file in the office of the superintendent of the motor vehicle department a statement of his name, residence, and a description of each aircraft owned by him, and shall also be required to give such information concerning his machine as may be required of him by the superintendent. The superintendent in turn will be required to register the aeroplane and assign it a license number of similar character to those supplied to automobile owners. Licenses will not be issued to any person under nineteen years of age. The registration fee will be $5.00 and the fee for examination of applicant will be at the jurisdiction of the superintendent, the sum of such fee not to exceed $25. Under the bill acrobatics will be prohibited at a lower altitude than 1,500 feet when over open space and entirely forbidden over cities.

The third bill is to pave the way for the establishment of a system of landing fields for aeroplanes adjacent to the principal cities in California, such landing fields to be constructed, maintained and controlled by the State Highway Commission.

The Bermuda and West Atlantic Aviation Company

The Bermuda and West Atlantic Aviation Co., organized in May, 1919, by Major H. Hemming, A.F.C., and Major H. H. Kitchener, conducts aerial tours of the islands and is planning a line to establish aerial communication with the United States.

The company is also carrying out service in the West Indies for the Colonial Governments and also for oil companies. The latter are both prospecting for oil and mapping their holdings by air. It has been found that oil territory is easily distinguishable from the air because of the barren and discolored character of the vegetation.

(*Concluded from page* 368)

Each school is under the care of an official Director, who forms the link between the Flight Cadets, the head of the School, and the Department of Military Aeronautics. It is on his reports that the grants are made.

This method of ensuring a constant supply of pilots will certainly be continued by the Aeronautical Department.

It has been objected that the sum of 2,000 francs granted is not sufficient to cover the cost of board and lodging. That is true, but the French Budget does not allow of much expansion along this line. It is a question of making other arrangements in the future and of providing the flight cadets with board and lodging during their period of training.

Wireless on Aeroplanes

This is to be controlled by the Government. As stated above, the Under Secretary of State for Aeronautics has issued a number of orders regulating the installation of various wireless stations needed for the air service. The Service of Aerial Navigation will assume the direction and operation of these stations. The location of the stations and their technical characteristics (wave length, power, etc.), will be established by mutual agreement with the Ministry of Posts and Telegraphs, in order to avoid any confusion. Some of these stations may be open for public use, always by an agreement made between the two Under Secretariats.

Wireless stations on aeroplanes are divided into two classes: (a) Those serving for security of aerial navigation and for private communications; (b) those serving only for the security of aerial navigation. The wireless plants used must be of the type authorized by the Government, and are under the permanent control of Government officials who are to be allowed on board any aircraft at any time for the purposes of inspection.

The Service of Aerial Navigation has already installed powerful stations in various places, the most important being at Saint-Inglevert, Maubeuge, Le Bourget, Lyons, Nimes, Marseilles, Antibes, Bordeaux, and Toulouse, that is, in the most important French Aerial Stations.

Rules for Aerial Navigation

The French "Official Journal" has recently published the text of a convention between France and England regarding aerial navigation. This convention establishes the principle that the two Governments shall permit the free passage of private and commercial aircraft over each other's territories, reserving the right to prohibit flying over certain military zones. All aeroplanes must have a log book and a certificate of airworthiness. The pilots must be in possession of a license. Wireless must not be installed unless by special permission.

This convention is only of a temporary nature, and is only valid until the International Convention for Aerial Navigation formulated under the terms of the Peace Conference, shall become operative. (*Note from the National Advisory Committee for Aeronautics*)

The AIRCRAFT TRADE REVIEW

Seaboard Consolidated Airlines

The Seaboard Consolidated Airlines has been organized with executive offices in New York City and branch offices in Chicago, Philadelphia, Detroit, Boston and Atlantic City. The company will operate a fleet of reconverted naval boats in daily service between New York, Atlantic City, Philadelphia and Washington.

The *Atlantic City*, the first boat to be put in service, was given its initial test on May 29, when it flew from New York to Atlantic City in 57 minutes carrying 23 passengers.

The ships are modern in every respect and are luxuriously equipped with every convenience. Each plane is equipped with wireless telephone and the company is taking full advantage of the radio meteorological service of the navy.

The company has a fully equipped wireless telephone station on the roof of the building in which the executive offices are housed, the equipment having a range of 500 miles for sending and 3,000 miles for receiving. This means that all boats en route are constantly within communication with headquarters.

The Gulf Aero Transport Company

As a result of several months' active flying on the Mississippi River, Ray P. Applegate has established the Gulf Aero Transport Company at New Orleans, La. The company undertakes passenger, newspaper and express transportation and transports many of the Bar pilots from New Orleans to Pilot Town when they are short of pilots at either end. This happens very frequently, and the new aerial service has added greatly to the dispatch of work on the river. During the racing and tourist season the company carried over 750 passengers without an accident of any kind and aroused great enthusiasm locally by this achievement.

As an indication of the efficiency of aerial travel the company by transporting pilots from the upper river between New Orleans and Baton Rouge for the Standard Oil Co. saves the organization twelve hours on each trip involved.

Packard Engine Test

The Engineering Division at McCook Field has recently completed a 50-hour test of the first Packard Model 1237 engine delivered under a recent contract for twenty-five engines. This engine is a 12-cylinder, "V" type, having a bore of 5 in. and 5¼-in. stroke. The cylinder banks are set at an angle of 60 deg.

An interesting feature of this engine is the use of 6½: 1 compression ratio which requires that the engine be throttled somewhat at sea level in order to prevent preignition. As the altitude increases, the throttle is gradually opened until an altitude of 6,000 feet is reached, when the throttle may be wide open. This arrangement gives a constant power output up to 6,000 feet altitude.

The engine ran very well during the 50-hour test and no major difficulties were encountered. The only points which seemed to require correction were the magneto coupling and the valve stem guides; the former appeared to be too flexible for satisfactory operation and the latter showed excessive wear in some cases.

This engine appears to be very well adapted to pursuit work as its power to weight ratio is very good and its operation appears exceptionally smooth and free from vibration.

On the right: Frederick H. Lemon who established a new low altitude record for parachute drop at El Reno. B. H. Griffin, shown in the picture, was pilot

Auto Engineers Discuss Piston Rings

The Washington Section of the Society of Automotive Engineers met at the Cosmos Club recently to hear a talk on the design of piston rings, by Mr. H. H. Platt of Philadelphia. Mr. Platt showed mathematically and by test results that leakage through the gap of a piston ring was of no importance, and that the various devices to reduce this leakage, now on the market, are of no value. The important point for consideration, he said, was to have the ring fit the cylinder perfectly, as most leakage occurred by the gas passing between the ring and the cylinder wall. Although this is generally agreed by automobile engineers, many of the general public still buy rings in which the main selling point is the careful sealing of the gap.

Aeroplanes and Safety

Under the title of "Aeroplanes and Safety" the Travelers Insurance Company have just published a booklet which will be read with interest by insurance agents throughout the country. This book contains an elementary account of the construction, operation and maintenance of aeroplanes; the planning, construction and maintenance of landing fields; and the relation of these subjects to accident prevention and aircraft insurance. It is well illustrated and contains about 130 pages of interesting data.

New California Landing Field

Aroused by the need of an emergency landing field in the Coachella Valley, the citizens of the town of Thermal, California, have cleared the brush from a strip of land alongside the town, leveled it, and marked it with a T. Thermal is about ten miles northwest of the Salton Sea, and at the half-way point of the Riverside-Imperial Valley air route and also of the Riverside-Blythe hop.

The field is about 200x800 feet, lying northwest-southeast, along the S. P. railway right of way. Condition, smooth, but soft.

This is the only emergency landing field between Banning and the Imperial Valley, and will be welcomed by those using this route. Gas (high test or ordinary) and air may be had at the field.

Book Review

The Log of H. M. A. R 34 by E. M. Maitland, C.M.G., D.S.O., A.F.C. is a vivid narrative of one of the most astonishing voyages in history, the 3,000 mile journey of the R 34, Britain's largest and most efficient Rigid Airship, from London to New York, by one of her crew, Air-Commodore Maitland who describes the writing of his book as follows:—

"Every word of this diary was written on board the Airship during the journey, with the exception of the explanatory footnotes and, of course, the appendices:—the writer perched in odd corners, and amid continuous interruptions and ever-changing surroundings, to the silent accompaniment of the wireless, like ghostly whispers across lonely space Every incident, important or trifling, was recorded at the actual time of happening. Even to stop to focus or to pigeon-hole these would have been to destroy actuality."

ORGANIZATION OF FRENCH AERONAUTICS

Establishment of a National Meteorological Bureau (N. M. B.)

Up to the present time the Meterorological Service in France has been carried out by various technical and administrative centers working independently of each other. Experience has shown the inconveniences inherent to such a multiplicity of organs. From the scientific point of view, questions of general interest run the risk of being studied by several establishments at the same time, without there being any mutual agreement on the subject, while questions, which, by their difficulty, call for the united resources of all services, may be delayed or even never undertaken. The multiplicity of management also diminishes the authority of the services. Relations with foreign Weather Bureaus, of such essential importance in meteorology, are not sufficiently defined.

The development of aeronautics has brought out the serious import of these drawbacks and it was felt necessary to form a National Weather Bureau. The three Meteorological Services existing, namely, those of the War Ministry, the Naval Ministry, and the Ministry of Public Instruction, have, therefore, been grouped into one National Meteorological Bureau.

The Bureau will comprise a central establishment and provincial services. The central establishment will undertake research work, instruction, telegraphy and wireless telegraphy, and will have general technical control. The provincial services will establish in Paris and the Colonies a service of Weather Forecasts for the Aeronautical, Naval and Agricultural Departments. For carrying out its program, the N. M. B. will have large resources at its disposal, simply by the rational utilization of the funds of the united services.

The development of the Science of Meteorology will lead to important research work being undertaken in the upper atmosphere.

The Bureau will be attached to the Office of the Under Secretary of State for Aeronautics, in order to afford every facility for carrying out such research work at minimum cost. This may also lead to a better employment of Aeronautical Laboratories and of airships.

The N. M. B. has appointed an Advisory Committee to advise on all questions concerning the progress and development of meteorology.

This Committee is formed of:

Two members of the Academie des Sciences.

One representative of the Ministry of Agriculture.

One representative of the Colonial Ministry.

One representative of the Ministry of Post and Telegraph.

Two representatives of the Ministry of Public Instruction.

Three representatives of the Ministry of War, belonging, respectively, to Aeronautics, Artillery, Engineering.

Three representatives of the Naval Ministry (Aeronautics, Naval Artillery, and Hydrography).

Two representatives of the Ministry of Public Works, belonging, respectively, to the Office of the Under Secretary for Aeronautics and to the Service of Roads and Bridges.

One representative of the Merchant Marine.

The Director of the Paris Meteorological Service.

The Director of the N. M. B.

Other members may be proposed by the Committee, chosen on account of their work in meteorology and their contribution to this Science.

Regulations for Aerial Navigation in France

This question is regulated by a series of decrees:

Decree on the use of Wireless in Airships. This decree regulates the wireless stations established by the Government Service of aerial navigatino and stations which may eventually be established by companies or private persons. It also regulates the installations on board airships.

A Decree Relating to the Licensing of the Sailing Personnel in Civil Aeronautics. Separate licenses are issued to pilots of touring machines, pilots of transport aeroplanes, pilots of free balloons, pilots of airships of the first, second and third class (third class, less than 16,000 cubic meters; second class, less than 20,000 cubic meters; first class, special license for aerial navigation of any size ship. In the license it is stated that the function of the aerial navigator is to study, trace, direct, and follow the route). The necessary conditions for obtaining the license are given, as well as the correspondence in value between these licenses and army and foreign licenses, etc.

Budget and Program for 1921

The Budget for the Under Secretariat of French Aeronautics amounts to 128,794,930 francs. Mr. Flandin, the late Under Secretary, asked for an increase of about 56 millions.

Broadly stated, the policy of the Under Secretariat for Aeronautics is as follows: "To create a national network of aerodromes, to organize the meteorological and wireless services, to commence the construction of rigid airships and to afford pecuniary encouragement to Navigation Companies and Aircraft Manufacturers."

Eight million francs have already been granted to 22 Companies which from July, 1919, to July, 1920, operated the lines Paris-Lille, Paris-Brussels, Paris-Geneva, Toulouse-Rabat-Casablanca, Bordeaux-Toulouse-Montpellier-Nimes-Nice, Paris-London, Bayonne-Bilbao-St. Cyr near Paris (airships) Paris-Strasburg-Prague. The following lines have also been recently opened or will be opened in the immediate future: Paris-Warsaw, Paris-Bordeaux, Paris-Verdun (circuit of the Battlefields) and Antibes-Tunis.

In twlve months 628,123 kilometers have been covered without casualties. An increase of 23,000,000 francs is anticipated to be paid as premiums to the companies organizing the great international lines with daily services and connections between France and northern Africa (Morocco, Tunis, Algeria); 2,000,000 francs for the Society of Pilots and 1,000,000 francs for the Colonies.

The Aeronautical program provides for the creation of an airport at Orly and for the construction of two rigid airships. The sum of 16,000,000 francs has been requested to cover these expenses. The works at the airport were begun in 1920 and the two rigid airships are to be completed in 1922.

The airport of Maubeuge has been prepared for receiving the airships delivered up by Germany.

Besides all this, hangars are to be built this year at Marseilles, Algiers, Casablanca, and Tunis, for the balloons working the line between France, Algeria, and Morocco. These hangars must be finished by 1922, otherwise the rigid commercial airships to be completed by that date cannot be utilized for want of suitable housing.

A network of landing grounds will also be made.

The five great aerial international routes: Paris-London, Paris-Brussels, Paris-Strasburg, Paris-Italy by Dijon and Marseilles, Paris-Spain by Bordeaux, will soon be worked regularly, while the aerodromes of Tunis, Algiers, Oran and Casablanca are being rapidly completed. The aerodrome at Le Bourget is almost, if not quite, ready, and the custom house station at Saint-Inglevert will be ready by the end of the year.

Besides these land aerodromes, three seaplane bases have been opened at Antibes, Bayonne and Ajaccio.

The 1921 program provides for the completion of all these routes, the construction of the subsidiary routes: Dijon-Geneva and Paris-Mezieres, and the beginning of the subsidiary routes: Tours-Nantes and Paris-Havre.

Two routes are to be constructed in Northern Africa: Algiers-Gabes via Tezeur and Oran-Fez-Casablanca.

A network of seaplane bases is to be establisred in the basin of the Mediterranean: Antibes-Marseilles - Perpignan and Tunis-Bone-Algiers-Oran-Azemmour-Agadir; also on the Swiss frontier at Annecy and Thonon, and on the English Channel at Havre.

It is also stated that the airport at Constantinople, established by a French Military Mission, will be attached to the French Under Secretariat for Aeronautics, and will function under the same conditions as a French airport.

The Technical Section of Aviation is to complete its installations at Villacoublay and Isay-les-Moulineaux. The Gazaux School will improve its equipment for bombing experiments, and an appropriation of one million francs is to provide for the installation of a center for seaplane experiments.

A sum of 48,000,000 francs is requested for studies and experiments undertaken by the Technical Section of Aviation for aeroplane and engine competitions organized by that section, and for running the plant established at Metz for producing the hydrogen required by balloons and airships.

Speed Record

At Villacoublay, on December 12, the aviator Sadi-Lacointe beat the world's speed record, up to then held by Romanet, who made 309.12 km. on a Spad machine with Hispano-Suiza engine.

Sadi Lacointe, on a Nieuport, with Hispano-Suiza engine, made 313.043 km. over a track one kilometer in length, which he covered four times, twice in each direction. On the first lap the speed was 321.428 km. This Nieuport is of the same type as that which won the Gordon Bennett Cup.

New Aeroplanes

The Farman firm has built a School Biplane with dual control equipped with a Renault 120 h. p. engine. The landing gear is the same as in the Maurice Farman. With this landing gear it is almost impossible for the machine to capsize.

A four-passenger aeroplane is now being tested by this firm. This machine has one Renault 375 h. p. engine placed forward; useful load, 600 kg.; weight

per square meter, 28 kg. Also a three-engine aeroplane, which will take part in the competition for military aeroplanes. This aeroplane is similar t othe Goliath, only that a third Salmson 260 h.p. engine is installed forward.

Ten David Farman Sport aeroplanes have recently been completed and sold to private persons; some of these aeroplanes are equipped with an Anzani 75 h.p. engine instead of a Rhone 60 h.p.

The results of the flights made by the Goliath on the Paris-Brussels route have been very gratifying . During last year about 1500 hours' flight were accomplished on that route without any breakdown.

The rates fixed for carrying passengers and freight on this route were calculated to cover the value of the machine in 250 hours' flight, but experience has shown that this figure was far too conservative.

For staying power, the Goliath holds the world's record, having made a continuous flight of 24 hr. 19 min. 17 sec., covering a distance of 1915.200 km.

New Constructions

An aeroplane with variable area of lifting surface, built by Latham, Gastamoide-Levavasseur, has been tried at the Villesauvage aerodrome. This aeroplane is competing for 100,000 franc prize offered by the "Union for Aerial Security," and has given satisfactory results during the tests. The aeroplane was piloted by Grandjean, and at the start the upper wing had a depth of 1.76 meters. In full flight, the pilot reduced the area of the lifting surface to a minimum, that is, to 1.60 meters. After flying for some time, when at an altitude of about 50 meters, he gave the upper wing its maximum depth, that is, 3.28 meters, and was able to land slowly and exactly at the desired spot.

The change in wing area is brought about slowly and in no way disturbs the balance of the aeroplane. The upper wing is made in three parts, the central part being fixed, and the other two being made to slide over it by means of a device controlled by the pilot. Only the upper wing is made in this way, and the area of the surface can be varied between 30 and 50 square meters. This aeroplane has a 250 h.p. engine, and a speed of 60 to 200 km-hr.

Although the experiments made came well within the conditions prescribed for the competition for the prize offered by the "Union for Aerial Security," the flights made at Villesauvage could not be considered official on account of the absence of the commissaries.

Grants to Flight Cadets

These were instituted in order to induce young men to be trained as pilots before beginning their military service. These young men, drawn from various schools, receive on signing for their apprenticeship as pilots, a sum of 1,000 francs, to cover the cost of board and lodging. A further sum of 1,000 francs is granted when they obtain their military license. They must submit to the discipline of the school in which they are trained, and must engage to serve for ten years in the military air service, either in the standing army or in the Reserve Corps.

These courses of training began at various centers in September of last year.

Captain Freysange is in charge of the inspection of these schools, and in an interview which he gave, expressed great satisfaction at the results already obtained. At the beginning of this year there were about 185 pupils enrolled, divided as follows: 29 with Hanriot at Rheims; 24 under Bleriot at Buc; the same number at Villacoublay with Morane-Saulnier; 16 at Orly with Nungesser. The others were at various schools in the provinces, as, for instance, with Caudron at Crotoy, with Farman at Tous-sous-le-Noble, etc. Captain Freysange stated that at the Crotoy school, the cadets were able to fly alone after only three weeks' training. Hanriot uses Morane-Saulnier aeroplanes for ground work, and Sopwiths with dual control for test flights. He has just produced a new aeroplane specially intended for school purposes. This aeroplane has a dual control system so arranged that the pilot can instantly correct any error on the part of the pupil.

(*Concluded on page* 365)

THE EFFECT OF ZINC PLATING ON THE PHYSICAL PROPERTIES OF STREAMLINE WIRE

General

An opinion appears to have arisen in the minds of some aeronautical engineers that streamline wire is seriously affected by the process of zinc plating. It is claimed that the wire is so embrittled by this process as to render it unsatisfactory for use. Such an effect would indeed be unfortunate, because of the imperative need for the protection of streamline wire from corrosion, and the superiority of zinc plating over other methods of corrosion prevention.

Judging from the reports received at these laboratories, the above opinion is based largely on the results obtained from torsion and bend tests. The question may well be asked whether these tests mean very much as far as the actual life of the wire under working conditions is concerned, and whether it is not fatigue tests rather than torsion and bend tests which give a reliable index of the manner in which the serviceability of streamline wire is affected by the electroplating process.

Fatigue tests had been conducted at these laboratories on fine wire springs, which showed that electroplating did not reduce the life of the spring and it, therefore, appeared inconsistent that streamline wire should be harmed by the same process. Accordingly, this investigation was undertaken to find out whether the brittleness, which is apparent in bend and torsion tests, has any relation to the fatigue-resisting properties of the wire.

Purpose

To determine the effect of zinc plating upon the physical properties of streamline wire, paying particular attention to the effect upon fatigue resistance and the reliability of bend and torsion tests in revealing its actual life period.

Conclusions

Zinc plating streamline wire renders it brittle only in so far as this brittleness is measured by bending and torsion tests.

Zinc plating streamline wire does not decrease its fatigue-resisting properties, but on the contrary, zinc plating has a tendency to increase fatigue resistance of streamline wire.

Material

Streamline wire used in this investigation was 5/16-inch carbon steel (1045), cold reverse rolled, manufactured by the American Steel & Wire Co. The material had been heat treated before finishing to streamline section.

The chemical composition of this steel is:

Carbon	0.400-0.5
Manganese	.500- .8
Phosphorus	.045
Sulfur	.050

The wires selected for testing were cut in the middle and one-half plated.

Method of Procedure

The following procedure was pursued in cleaning and plating streamline wire. It will be noted that this procedure duplicates very closely the commercial practice.

Treatment	Temperature °C.	Time
1. Immersed in commercial benzol	20	5 m.
2. Cleaned in electric alkaline cleaner	74	20 m.
Suspended from cathode.		
Composition of cleaner—		
12.5 g/L—Sodium hydroxide.		
20.0 g/L—Sodium carbonate.		
10.0 g/L—Sodium cyanide.		
Current density, 10 amp. 5 volts.		
3. Acid dip:		
10 per cent sulphuric acid (commercial 66° Be')	22	10 m.
4. Plating:		
Composition of solution.	20	1 hr. 30 m.
45 g/L—Zinc oxide.		
75 g/L—Sodium cyanide.		
15 g/L—Sodium hydroxide.		
Current density, 2 amp./dm² (20 amp./sq. ft).		

The wire was then allowed to stand for three days, after which bend, torsion, and fatigue tests were made on unplated and plated stock.

Three plated and three unplated specimens each 6 inches long were cut from the same wire for bend tests. These specimens were subjected to a reverse bend over a radius three times the thickness of the wire and every 90° bend counted.

The torsion test was made in an Olsen torsion machine by testing six plated and six unplated specimens 10 inches long over a 10-inch gage length.

Alternate stress tests were made on 18 plated and 19 unplated specimens each 3½ inches long covering a throw of the eccentric of 2.5, 2, 1.5, 1.25, 1, and 0.75 inches under a stress range of 30,000-140,000 pounds per square inch.

The fatigue test was made in an Upton-Lewis fatigue testing machine. This test consists in bending the specimen back and forth so that stress in the specimen is completely reversed for each cycle.

Results

The average thickness of the coating obtained in the plating process, was 0.001 inch. Examination showed this coating to

be very adherent and of good quality. It withstood the tests, without cracking, as long as the streamline wire itself did.

The results of the bend test gave an average of 12 reverse bends for the plated wire and 17 reverse bends for the unplated wire.

The results of the torsion test gave three complete twists up to rupture for the plated wire and six for the unplated wire.

The results of the fatigue tests are plotted on the attached graph, as follows:

Number of reversals of stress are plotted as ordinates, and corresponding stress as abscissas. The upper set of curves are the same as the lower, except that they are plotted to a larger ordinate scale (along right edge of graph), in order to show more clearly the shape of the curves at the higher stress ranges. In the range of stress from 30,000 to about 38,000 pounds per square inch the plated wire showed an exceedingly long life. The three dots, with arrows attached, indicate that these points might have been much higher, but the specimens were removed after having run what was considered a sufficient length of time to demonstrate that the life of the plated wire, without this stress range, far exceeded the life of the unplated wire.

Discussion of Results

From the results of the bend and torsion tests it appears that zinc plating makes streamline wire brittle. It would seem, therefore, that zinc plating should reduce the fatigue resistance of streamline wire, but such has not been found to be the case, as is shown by the results obtained in fatigue tests.

From the upper curves it is seen that the fatigue resistance is practically the same for both wires until a stress of about 100,000 pounds is reached, after which the curves begin to separate, slightly favoring the plated wire. After flattening out the curves run nearly parallel. However, the unplated wire has not nearly as long a life as the plated wire. The maximum life of the unplated wire in the vicinity of 35,000 pounds per square inch in stress is 930,000 cycles, whereas the plated wire was run as high as 4,115,000 cycles at 39,000 pounds per square inch stress and did not fail.

—*Air Service Information Circular.*

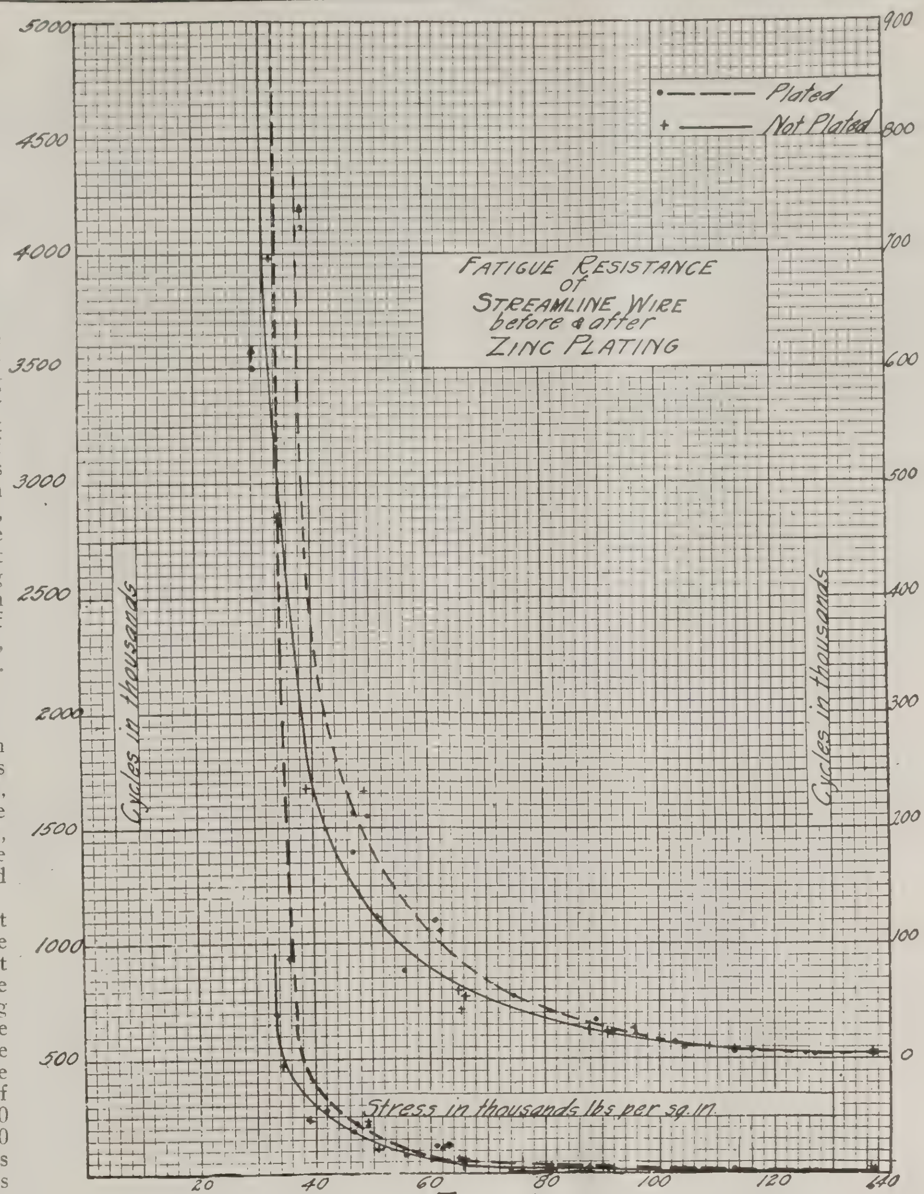


Fig 1.

METHODS FOR PREVENTING THE CORROSION OF METAL PARTS OF AEROPLANES

General

Accurate quantitative data has been singularly lacking on the actual corrosion-resisting powers of various commercial rust preventatives, which have been used as coatings for metal parts of aeroplanes. No thorough comparative examinations have been made on either methods or compounds to determine which give the most satisfactory results. Such data should be of interest to the Engineering Division, both for the purpose of selecting the most reliable rust preventative for use on aeroplane parts at this field, and for guidance in drawing up specifications for the protection of metallic aeroplane parts, a matter which is becoming of increasing importance with the gradually increasing use of metal in aeroplane construction. A thorough investigation is being conducted at this field of various methods of corrosion prevention, and it seems desirable to make a preliminary report at this time on the basis of some of the data which has been obtained.

Purpose

To investigate the efficiency of various methods of corrosion prevention.

Conclusions

Corol Compound is the best organic corrosion preventative (slushing compound) among those tested.

Zinc plating offers the best protection against corrosion of the metallic coatings tested.

Material

Test specimens of sheet steel of uniform composition were cut to uniform size, 4 by 6 inches, carefully cleaned to remove all rust, and thoroughly coated with material to be tested. These have been exposed out of doors for varying lengths of time. Periodic examinations have been made to ascertain the time of the initial appearance of rust and the rate of corrosion progression. Observations were recorded in terms of "Percentage surface corrosion." These values, plotted against the time factor, show graphically the actual length of time that each coating will keep a piece of steel from rusting.

The following list gives the name of the material tested, the manufacturer, and the character of the coating after 24 hours' drying:

ORGANIC COATINGS

Name.	Manufacturer.	Character of coating after drying for 24 hours.
African Slush.....	E. F. Houghton & Co., Philadelphia, Pa.	Black, hard.
Hippo Baking Varnish	American Chemical Mfg. Co., Norfolk, Va.	Transparent, dry.
Burnt Oil Coating	McCook Field, Dayton, Ohio	Black, dry.
Coro-Knot	Rust-Knot Mfg. Co., Toledo, Ohio.	Transparent, dry.
Corol Compound...	Corol Co., Chicago, Ill.	Transparent, grease.
Exhaust Pipe Enamel, Spec. No. 4...	Tower Varnish Co., Dayton, Ohio.	Black, dry.
Fokker Enamel....	Fokker Airplane.	Gray enamel.
NO-OX-ID A & C.	Dearborn Chemical Co., Chicago, Ill.	Semi - transparent, grease.
Parkerizing	Parker Rust-Proof Co. of America, Detroit, Mich.	Black, dry.
Red Enamel........	Empire Metal Aircraft Corp., College Point, L. I.	Opaque, dry.
Steel Gloss.........	E. F. Houghton & Co., Philadelphia, Pa.	Transparent, dry.
Whitmore Slushing Compound	Whitmore Mfg. Co., Cleveland, Ohio.	Opaque, grease.

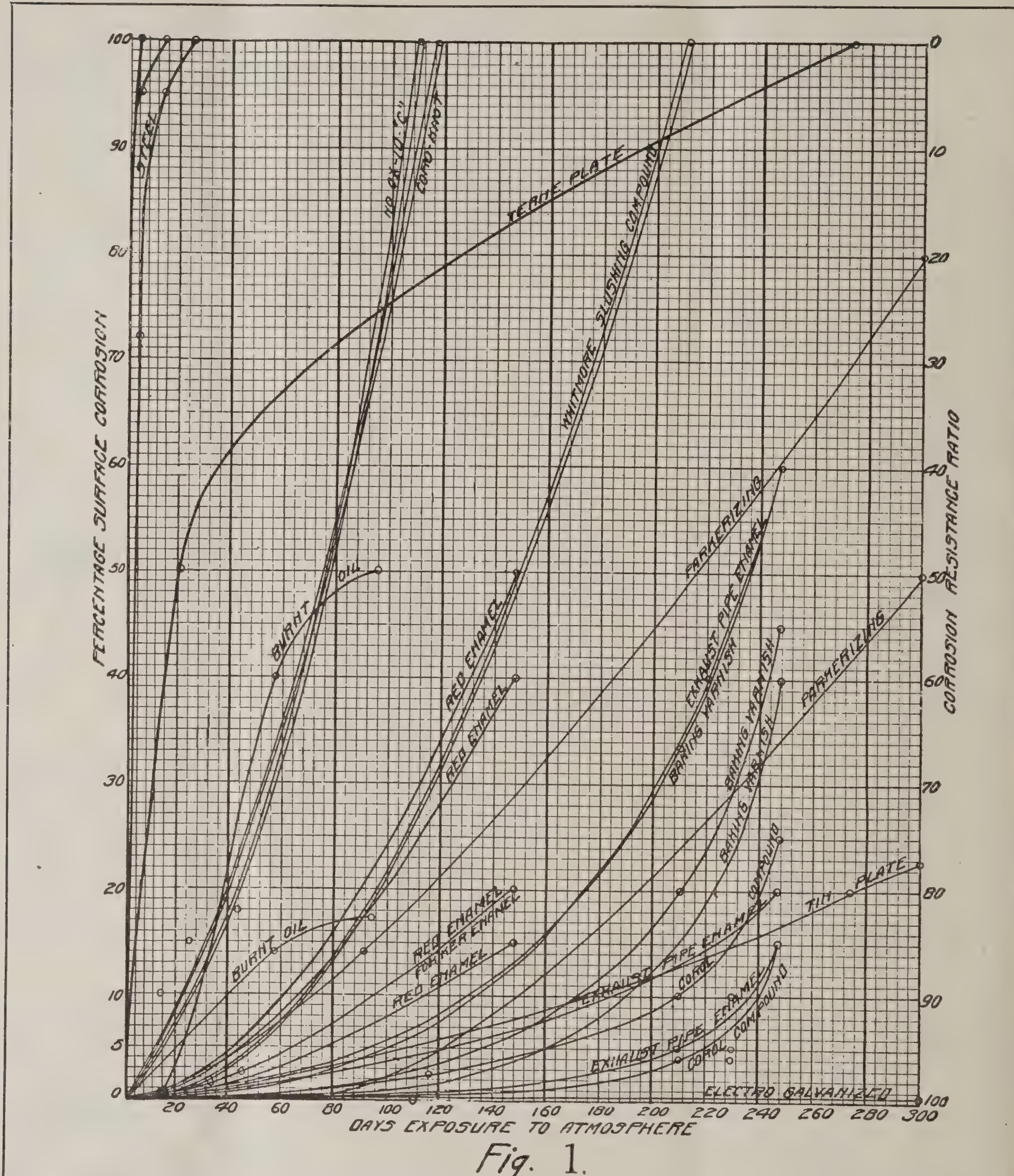


Fig. 1.

Metallic Coatings

Terneplate	From stock, McCook Field, Dayton, Ohio.
Tin Plate..........	do.
Zinc Plate.........	Chemical Laboratory, McCook Field, Dayton, Ohio.

Results

See attached graph.

Discussion of Results

There is no known method by which complete protection is afforded. At best, all coatings are only inhibitive agents. Examination of the attached graph shows that these coatings have marked variations in protective properties. It will be noted that the two pieces of steel coated with Corol Compound, and the two coated with Exhaust Pipe Enamel, have corroded the least. The Corol Compound coated samples rusted 15 to 25 per cent during 247 days' exposure, and the Exhaust Pipe Enamel sample rusted 15 to 20 per cent during 247 days. Zinc plating held up better than any other coating, corroding less than 1 per cent during 300 days.

—Air Service Information Circular.

AEROPLANE BALANCE

By L. HUGUET

(Technical Note from the National Advisory Committee for Aeronautics)

(*Continued from last week*)

It appears from the system of curves shown on Fig. 1, that if we assume a minimum tail setting, $\alpha^m = -20°$, the aeroplane will not be able to reach its angle of flight at the ceiling (this angle being about 12°) if its center of gravity, G, is at less than ¼ of the chord of the wing from the leading edge, that is, between o″ and o.

2nd. *Machines having the center of gravity between* o′ o″ (*about ⅓ or ¼ forward of the wing*) are stable at all angles of attack utilized in flight. They can be maneuvered at all angles up to the ceiling.

3rd.—*Machines having the center of gravity to the rear* (*at about ⅓ forward of the wing*) *at* o′, *for instance,* are in neutral balance at normal angles of horizontal flight at a mean altitude.

These machines are dangerous to fly; when they are put to a nose dive, they continue diving by force of inertia without the controls being touched, and only right themselves when the pilot sets the elevator at the angle corresponding to equilibrium at horizontal flight.

In order to right them, the pilot must intervene energetically.

For the same reason, when these machines are tail heavy they keep the same position.

These facts can easily be deduced from an examination of the curve $\alpha = 0°$ (Fig. 1).

We shall assume the aeroplane to be balanced for flight, such balance being marked on the figure by the point ω, corresponding to $\alpha = -5°$, $i = 11°$.

If the pilot wishes to nose dive, he increases α. Suppose he takes $\alpha = +5°$; the machine will nose dive, and keep on diving up to −10°, if the pilot keeps the same setting.

Moreover, the machine will continue diving by the force of inertia, even though the pilot returns to the setting $\alpha = 0°$ (the setting for normal flight).

As a matter of fact, with this setting, $\alpha = 0°$, the variation of the angle of incidence from $i = 7°$ to $i = 1°$, causes no displacement of the center of thrust, and therefore no torque intervenes to fix the machine at a given angle of attack within those limits.

For certain gliders, the angle of attack may thus happen to be negative before we find on the α curve a point of equilibrium corresponding to a center of thrust further forward than G and creating a righting torque.

It should be noted (though it may seem rather paradoxical) *that this dangerous defect of neutral stability arising from a center of gravity placed too much in the rear, may, in a free flight test, cause a tendency to nose dive. This might lead to the false assumption that the balance was placed too far forward.*

These machines with neutral stability are particularly dangerous in the take-off and may have a tendency to capsize instead of getting off the ground. I will return to this point later on.

4th.—*Machines having the center of gravity very much to the rear; beyond* o′o (outside the forward ⅓ of the wing) are in unstable equilibrium at normal angles of flight at low altitudes; they are only stable at large angles of attack.

In flight at small angles, if the aviator accidentally points the machine up, it becomes tail heavy; if he accidentally points it down, it becomes nose heavy.

These machines fly at small angles of attack with α generally positive (when the fixed plane is parallel to the wing); the tail has then lifting power.

In such machines the controls are usually inverted only for negative angles of attack.

Inverted Flight.—The α curves plotted on Fig. 1 are discontinuous.

The discontinuity corresponds to the actions of the air, and the general sweep of the curves at negative angles indicates that the conditions of good balance are of the same nature in flight in an inverted position as in normal flight.

Effect of the Position of the Axis of Propeller Thrust

Relative Position of the Axis of Thrust and of the Center of Gravity.—In the first part of the paper we assumed that the machine was one with coinciding centers, that is, that the center of gravity was on the axis of propeller thrust.

The component of the total resultant of the actions of the air we have called resistance to thrust, as opposed to the thrust of the propeller, when the other component is vertical.

Practically, there are no machines with exactly coinciding centers. The center of gravity is always either above or below the axis of thrust.

In studying the stability of a machine having exactly the same glider as that considered in the first part of this paper, but having its center of gravity G not placed on the axis of thrust, we can utilize the same curves, on condition of considering, not the position of G, but the position of g, the point at which the vertical passing through the center of gravity meets the axis of thrust (Fig. 8).

The result is that g is not fixed on the axis of thrust as G was.

g moves one way or the other when the

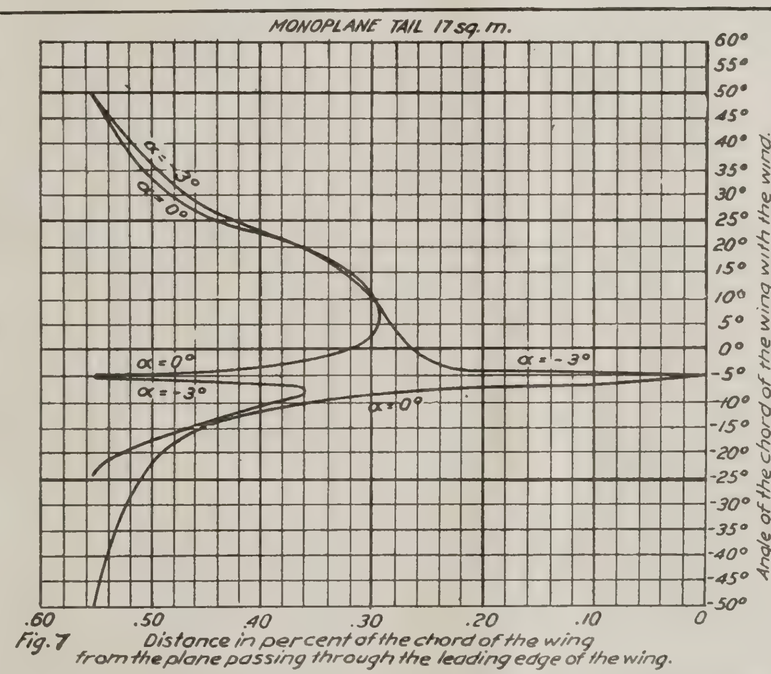


Fig. 7 Distance in per cent of the chord of the wing from the plane passing through the leading edge of the wing.

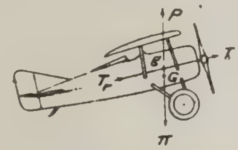


Fig. 8

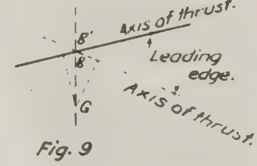


Fig. 9

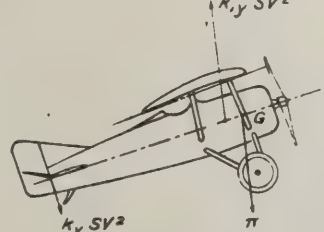


Fig. 6.

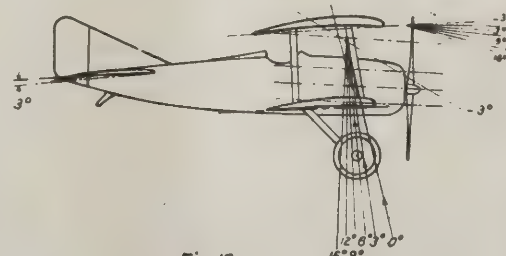


Fig. 10

angle of attack varies, according to whether G is above or below the axis of thrust.

We are still only considering a rectilinear régime of flight where the forces are in equilibrium.

In such a case, whenever g is in the region of good stability, the machine is stable, whatever be the position of G with respect to the axis of thrust.

Machines in which the center of gravity is not near the axis of thrust thus always possess a region in which the angles of attack correspond to good stability.

Machines in Which the Center of Gravity Is Below the Axis of Thrust.—For these machines the imaginary center of gravity g moves backwards when the angle of attack decreases and forward when it increases (Fig. 9).

Therefore if the balance is good at mean angles, there is a region of instability at small angles and a region at large angles of attack in which no maneuver is possible.

The displacement of g therefore presents an inconvenience in each particular case. At small angles of attack the machine becomes distinctly unstable, and has no maneuverability at large angles (if the center of gravity is sufficiently below the axis of thrust).

This case of defective balance may especially occur on seaplanes with hulls. Its importance evidently depends on the glider used in each particular case, for, as we shall see, the α curves depend on all the constituent elements of the glider.

Machines in Which the Center of Gravity Is Above the Axis of Thurst.—In these machines the imaginary center of gravity g moves forward when the angle of attack decreases, and backwards when it increases.

Therefore, when balance is good at mean angles, the machine, owing to the form of the curves, will be stable at large angles, although balance is to the rear, and will have maneuverability at small angles of attack like all machines having balance forward.

It thus appears that from the point of view of stability in rectilinear and uniform flight, there is a decided advantage in having the center of gravity above the axis of thrust. The distance between them must not, however, be too great.

Relative Position of the Axis of Thrust in the Glider

There is another reason why the position of the axis of propeller thrust is of so much importance in balance, and that is its relative position as affecting the whole of the glider.

In fact, the whole study is so far based on the displacement of the point of intersection *of the resultant of the reactions of the air and the axis of thrust.* Considering that this resultant varies in direction with the angles of attack, it follows that the displacement of the point of intersection will be more or less, according to the position of the axis of propeller thrust.*

This appears clearly on Fig. 10, which gives a metacentric sheaf corresponding to a given setting of the elevator.

The points of intersection of the different resultants with a given axis of thrust will define the abscissas of the α curve studied above as function of the angles of incidence.

* It should be understood that we assume (which is not exactly the case) that the axis of thrust can be displaced in the glider without affecting the magnitude and position of the passive resistances and hence without affecting the magnitude and direction of the general resultant of the actions of the air.

It further appears (Fig. 10) that the lower the axis of thrust in the glider the slighter the relative slope of the α curves.

The elevator has therefore become more sensitive, and the region in which the balance is considered to be good, o′ o″, is enlarged; the machine is more easily balanced and the operation is not so delicate.

If, on the contrary, the axis of thrust is raised in the glider, the center of thrust will vary much less for the same variations in the angle of attack, and hence the α curves have a much steeper slope. Consequently, the machine does not answer so readily to the action of the steering mechanism, and the region of good balance, o″ o′, is greatly reduced; all this necessitates extreme accuracy in construction if the machine is to have stability and maneuverability.

If the axis of thrust is raised still higher in the glider, if, in particular, it is in the vicinity of the metacenter corresponding to the case under consideration, stability will be neutral in the vicinity of the setting α and of the angle of attack which determines this metacenter.

For values of α or i corresponding to metacenters above the axis of thrust, the elevator regains a little efficiency. For values of α and i corresponding to metacenters below the axis of thrust, the machine will be unstable, for the corresponding α curves will slope in the contrary direction to those we have hitherto considered in the region of stable equilibrium.

We thus see that the position of the center of gravity with respect to the axis of thrust, and the relative position of the axis of thrust in the glider, are of the greatest importance in the balance of an aeroplane.

If it is desired to have a very stable machine, the axis of thrust must be placed low in the glider; it may then be below the center of gravity and will thus, for two reasons, facilitate good balance.

The positon of the axis of thrust in the glider is often decided by questions of construction or of practical use. In certain seaplanes such considerations lead to the axes of thrust being placed very high in the cellule; in such cases careful experiments should be made in the wind tunnel in order to find out whether this position of the axis of thrust renders it impossible to have a machine which is automatically stable at normal angles of attack. In cases where the machine is found to be still automatically stable, these tests would determine the exact region in which the vertical of the center of gravity must remain in order that the machine shall be stable and controllable at all angles of attack which it can utilize.

Initial Adjustment of the Tail Plane

The glider hitherto considered was that having a tail formed of a fixed plane and an elevator.

Since the object of the latter is to vary, by its setting α the K_y of the whole tail, it is evident that the form of the α curves will depend on the ratio of the area of the elevator to that of the fixed plane. The argument, however, is not affected, whatever this ratio may be; the same general sweep of the curves is kept, even though the whole tail plane is flexible. Figs. 7, 11, 12 are those of tails which are entirely flexible.

If the elevator has a fixed part and a flexible part, as on the glider hitherto considered, it is well to adjust the fixed part so that, in horizontal flight at the normal altitude of utilization, the flexible part of the tail plane shall be in the bed of the wind, thus causing no fatigue to the pilot.

The best solution is evidently to have a fixed plane which can be regulated from the pilot's seat, so that this reduction of fatigue may be realized for all régimes of flight which can be utilized.*

For machines in which the fixed part of the tail plane cannot be regulated, it should be initially adjusted so that, at the angle of flight at the altitude considered, the elevator being in the prolongation of the fixed plane, the whole of the tail shall be set so that the center of thrust is on the vertical of the center of gravity.

Tests have been made under these conditions for the glider considered, with tails of various shapes and dimensions.

The curves of these tests have already been given in Figs. 7, 11,* and 12. By these curves we see that, when the whole tail plane is flexible, the phenomenon is exactly comparable to that studied in the case where only the elevator was flexible.

From the curves shown in Figs. 7, 11, and 12 we may conclude that, for a given glider flying at a given altitude at an angle i_0, the machine being all the more stable at the center of gravity is further forward, the tail plane will have a negative adjustment with respect to the chord of the wing, and this negative adjustment will be greater as the machine is more stable.**

Stability at a normal régime of flight at a normal altitude will thus be usually characterized by the upward V formed by the chord of the wing with the chord of the tail plane.**

Machines adjusted with a downward V (lifting tail) will be very near instability, and will assuredly be unstable at small angles of attack.**

Stability at the Start

In this paper we have stated that an aeroplane balanced too far back, and consequently almost neutral as to stability, has a tendency to capsize at the take-off.

In order to prove this tendency we will begin by determining the best position for the landing gear, that is, the position of offering the greatest safety, both when the machine is running along the ground, with its skid down, after landing, and when it is taxi-ing along, tail up, before taking off.

Many authors advise the adoption of a large ground angle, that is, to place the landing chassis in such a way that the wheels touch the ground very far in advance of the center of gravity.

According to these writers, this ground angle should be about 20° when the machine is in the line of flight, hence about 35° when the skid is on the ground.

This would allow the aeroplane all

* British Transport Planes especially have been designed with this idea. Several interesting devices were shown at the last French Aeronautic Show.

** We are led to these conclusions by considering that, in order to keep the equilibrium of forces we must, in advancing the center of gravity, set the tail so that it will lose lift to such an amount that the righting torque created equilibrates the driving torque due to the new position of the center of gravity.

These conclusions are only absolute for symmetrical empennages; we may, in fact, conceive of tail profiles (inverted wing profile) such that the tail has no lift though its chord does not form a V with the chord of the wing. There would be great advantage in studying such tail shapes, the use of which might considerably modify the sweep of the curves and reduce the head resistance of the empennages while keeping and even increasing their efficiency.

In particular, we may see the possibility, with such tails, of balancing aeroplanes, without any ill effects, more to the rear than is done on our present machines.

safety of movement on the ground after landing when the skid is on the ground.

The large ground angle makes the machine tail heavy and the skid therefore acts as a strong brake. An angle of 35° would, however, seem excessive.

An incautious increase of this ground angle can only give rise to inconvenience, and that for two reasons:

First, because it will make the machine more likely to run crooked when rolling along with the skid on the ground, and also because it decreases stability at the take-off and increases the chance of the machine capsizing, as will be shown later.

Without taking into account the position of the axis of thrust, let us assume that the aeroplane has coinciding centers and that, although the wheels are on the ground, a uniform régime is established for a very short time, the machine being in the line of flight (Fig. 13).

Consider the equilibrium of the forces when the aeroplane has a large ground angle, the wheels touching the ground greatly in advance of the center of gravity G:

The machine is then maintained in the line of flight by the action of the elevator set at $\alpha = +x$, so that at small angles of attack the center of thrust for the whole of the glider is sufficiently far back to ensure the moment of the reaction to lift with respect to the center of gravity, equilibrating the moment of the reaction of the wheels with respect to the same center of gravity. The reaction of the ground on the wheels is not normal to the ground, it has a horizontal component equal to the product of the vertical component and the coefficient of friction of the wheels on the ground.

The total resultant is thus slightly inclined to the rear; it nevertheless passes in front of the center of gravity of the machine, so that, in order to balance it, the thrust due to the actions of the air must, on the contrary, pass to the rear of this center of gravity.

The result is that if the machine is normally balanced very far back, the center of thrust at the take-off will very probably fall on the sheaf of α curves corresponding to unstable balance.

In this case if, for any reason the machine begins to point up, it will continue in that position unless the pilot acts on the elevator, but finds a position of equilibrium when the righting torque of the actions of the air balances the carrying torque of the wheels, the moment of which has always a maximum.

If, on the contrary, the machine begins to point down, the center of thrust moves rapidly backwards and the machine continues nose diving. The reaction torque of the wheels, which might oppose this movement, does not necessarily increase, for though the reaction of the ground may increase, its lever arm decreases owing to the change in the direction of the aeroplane.

Under these conditions the machine will most usually capsize before the pilot has time to intervene.

When the wheels touch the ground near the vertical of the center of gravity, the position of the center of thrust corresponding to balance also approaches G and may be in the region of good stability.

It is perfectly clear that only aeroplanes having the center of gravity very much forward can tolerate a large ground angle, and the further back the machine is balanced, the greater must be the reduction in the ground angle.

We have examined the question of stability of balance without mentioning the causes which may disturb it. One of these causes is the ground, the inequalities of which may increase or reduce the reactions on the wheels and change their direction.

For instance, an inequality of the ground which increases the reaction, generally inclines it, at the same time, further to the rear.

If the inequality of ground increases the torque due to the wheels, the machine will point upwards and the angle of attack increases, but if the center of thrust is in a stable region, it moves backwards and will again find a position of balance. When the effect of the inequality ceases, the machine will resume its position.

If the inequality of ground reduces the torque due to the wheels, the aeroplane points downwards, the center of thrust moves forward if it is in a stable region and recovers a position of equilibrium.

In short, when the actions of the air are sufficient, when the aeroplane can taxi along in the line of flight, for instance, a large ground angle does not increase safety, but, on the contrary, reduces it.

Machines balanced too much to the rear are, generally, unstable at the taffe-off and have a special tendency to capsize; this tendency increases with increase of the ground angle.

Even for well-balanced machines it is better to have a small ground angle when the aeroplane is in the line of flight, 3 to 5°, so that, when the skid is on the ground we shall have a ground angle of 15 to 20°, sufficient for taxi-ing with safety.

The ground angle required for the aeroplane to run along the ground, skid down, may be still further reduced if there are emergency wheels in front to check any tendency to capsize on a poor terrain.

(*To be continued*)

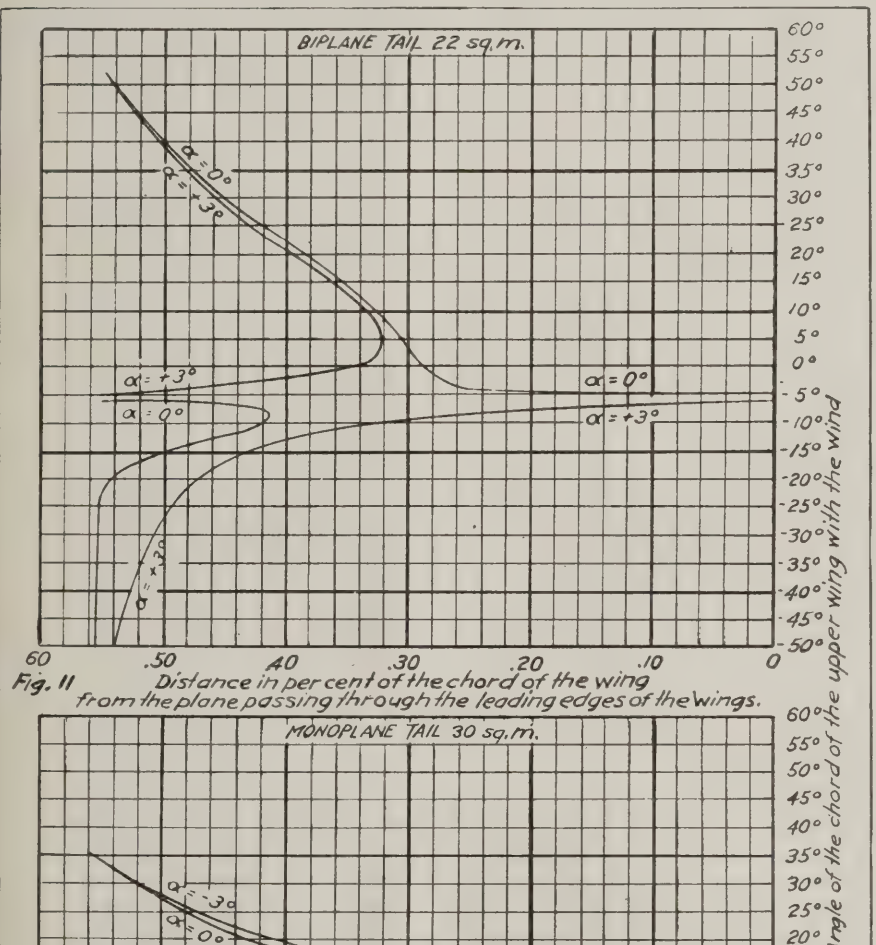


Fig. 11 Distance in per cent of the chord of the wing from the plane passing through the leading edges of the wings.

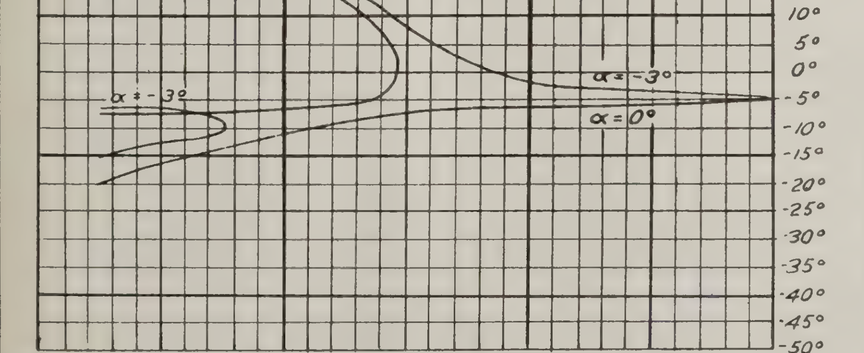


Fig. 12 Distance in per cent of the chord of the wing from the plane passing through the leading edge of the wing.

FOREIGN TECHNICAL DIGEST

Aircraft Machine Guns

The author traces the history of the utilization of the machine-gun as an aircraft weapon, outlines the conditions which have to be met in aerial warfare, and shows the means adopted by the various belligerents to meet them in the course of the late war. (W. T. Gorton, *Army Ordnance,* Jan.-Mar., 1921. 10½ cols.)

Luminous Beacons

After a discussion of the dangers of night flying and the difficulties of navigation by present methods the writer proceeds to outline the requirements of a system of ground lighting of air routes. A brief history is given of the development of projectors, followed by a paragraph on the choice of a luminous source, in which are given some interesting data on the electric arc. The next section is devoted to the "G.M.G." electric arc, manufactured by the Société des Etablissements Luchaire, in which the negative electrode consists of an annular metal ring, cooled internally by the circulation of a stream of water, and the attachment of the carbon positive is similarly cooled, permitting the use of high currents with relatively small electrodes. By the introduction of a magnetic field whose axis lies along the carbon—perpendicular to the plane of the metal ring—the arc is made to rotate rapidly around the latter, resulting in a steady source of light of great intensity (69,000 c.p./sq. cm.). The article proceeds with a description illustrated by drawings, of the various optical systems used in lighthouses, giving formulae for calculating the illumination at a given distance, etc. The whole subject of the lighting of airways is fairly exhaustively treated, within the limits of space of such an article. (*L'Aerophile,* Apr. 15, 1921).

Aero-Technical Laboratories

The practical value of wind channel research in its direct application to aircraft design is emphasized, and the article proceeds with a description of the principal wind channels owned by private firms in various countries, including those of Curtiss, Boulton and Paul, the semi-official Deutsche Versuchsanstalt für Luftfahrt (Aldershof) and Versuchsanstalt für Aerodynamik (Geottingen), Junkers, and Zeppelin. The excellence of the German installations is admitted, and the conclusion is drawn therefrom that Germany is preparing to make a bid for supremacy in the air, as she tried to on the sea before the war. (*L'Aerophile,* Apr. 15, 1921.)

The Aviette

The writer demonstrates in a very clear manner the theoretical and practical impossibility of making a success of the man-powered aeroplane, and recommends that the attention of enthusiasts be diverted to the development of the "motoaviette," a much more encouraging proposition. (*L'Aerophile,* March, 15,1921.)

The Avia B.H. Monoplane

A two-seater monoplane by the Avia Co., Prague, having a number of interesting features. The wings are mounted on the bottom longerons of the fuselage, and are braced by a pair of struts from the top longerons to a point about one-third along the semi-span. Owing to the long overhang of the outer bay, the wing section is very deep, to allow for a suitable spar section. This position of the wings was chosen for the purpose of obtaining the greatest possible visibility. The wings are covered with fabric, but the ailerons are constructed of three-ply. The tail plane is of the cantilever type; large divided elevators are fitted, and a balanced rudder is hinged to the stern post of the fuselage. Photographs and scale drawings are given.

SPECIFICATION :—
S.—35 ft. 5 in.
L.—19 ft.
H.—6 ft. 8 in.
A.—116.2 sq. ft.
M.—35-40 h.p. Austro Daimler.
N.W.—582 lbs.
G.W.—1,012 lbs.
S.L.—8.7 lbs.
P. L.—25.3 lbs.
Max. V.—68 m.p.h.
C.M.—3,300/10.
with 26 h.p. motor. (*Flight,* Apr. 21, 1921).

Experimental Aerodynamic Data

A description of some of the more interesting and unexpected effects which have been discovered in aerodynamical research. In experiments with spheres it was discovered that there is a pronounced scale-speed effect, particularly noticeable at the lower speeds. If the resistance is expressed as $R=KSC^2$, where R is the drag in kg., S the maximum cross-sectional area in m^2, and V the wind speed in m/sec., the coefficient K for a sphere of 16.2 cm. diameter falls from 0.032 at $V=4$ to 0.009 at $V=15$, after which it gradually increases with speed to a sensibly constant value. The drop in resistance is at first fairly slow, but between $V=10$ and $V=15$ there is a critical period in which the fall is very rapid. This critical period is so well marked that the ACTUAL RESISTANCE of the sphere at $V=15$ is only some 72 per cent of that at $V=12$. The critical speed varies with the size of sphere, as also the resistance coefficient K. At higher speeds this difference in the value of K disappears.

Similar effects are also found with other forms. Figures are given for cylinders of 15 and 30 cm. diameter. As an example of the importance of the scale-speed effect it is noted that the value of K for a thin wire has been determined as 0.06, as against 0.02 for the larger cylinders. It has been proved that this difference is not due, as might be supposed, to vibration, which apparently has no noticeable effect.

Streamline bodies are next discussed. For fairly low speeds the best form has its maximum cross-section one-third of the length of the nose, but for higher speeds it seems that half way along the length is the best position.

In treating of wing sections it is stated that with a monoplane it is useless to increase the aspect ratio beyond 7, partly for structural reasons, and partly because the lift coefficient decreases above this value. With a biplane this is not so, with the result that a biplane structure of high aspect ratio is actually more efficient than the corresponding monoplane. It is noted that the aspect ratio of the lower plane of a biplane is relatively unimportant. With regard to balancing of controls, the best ratio of area in front of hinge/area behind hinge appears to be about 0.08 for small machines.

The article concludes by suggesting a method of testing models on a balance attached to an aeroplane, by balancing the force on the model against the drag of a flat plate of variable area, the area necessary being a direct index of the required resistance. It is followed by an appendix by Robert Gsell, in which the values of the symbols used in French and German aerodynamic laboratories are compared. (*La Suisse Areinne,* No. 6, 1921.)

Helicopters and Aeroplane-Helicopters

A year ago the author contributed an article to *L'Aeronautique* on Helicopters and the advantages which would attend this type of apparatus, and the services it would render in the future. He returns to the subject, and with the additional light of the past year's experience, considers the following points:—(1) Hovering without translational speed; (2) stability; (3) returning safely to the earth in case of breakdown of motors.

Various types of machines are described, one of the most interesting being the Austrian helicopter, which consists of two screws turning in opposite direction, driven by three Le Rhone 120 h.p. motors. The Damblanc-Lacoin and the Crocker-Hewitt are described with diagrams.

Stability in a helicopter must be at least as good as, or, if possible, better than an aeroplane. Two means of controlling stability which have been tried are: (1) Small fins placed in the slip stream of the airscrews and warped by means under the pilot's control. The chief defect being the variability of the slip stream; (2) warping the blades of the airscrews, the disadvantage of this method being the mechanical complication.

Neither system has been tested thoroughly, and so far the most information has been obtained from small scale models, which, however, have demonstrated that "there exists for a helicopter an inherent stability analagous to that of an aeroplane." In case of breakdown of the motors the retardation of descent due to the air turning the airscrews insufficient. Increasing the angle of incidence of the blades has been tried, but here again mechanical complication is a grave defect.

For horizontal propulsion three principal methods have been tried: (1) To add a horizontal airscrew similar to that of an aeroplane. This scheme is open to the grave objection that when travelling horizontally the air reactions on the vertical airscrews are not symmetrical, being stronger on the advancing than on the other side, giving rise to bad vibrations; (2) inclining the axis of the vertical airscrews towards the horizontal, but little is known of the action of airscrews under these conditions. Moreover, the objection to (1) is partly present; (3) changing the angle of incidence of the blades so that for a part of a revolution the forward thrust is greater than for the other part.

The authors consider that the helicopter-aeroplane will be the first step towards solving the problem of safe flying, and afterwards the helicopter will be developed therefrom. (Capt. M. Lame, *L'Aeronautique,* Jan., 1921.)

NAVAL and MILITARY AERONAUTICS

The Course of Aircraft Armament at Chanute Field

One of the most valuable courses in the Air Service Mechanics School, and one of the most interesting, is the course for Aircraft Armament. There are two curriculums; one for officers, which covers a period of ten weeks, and the enlisted men's which covers a period of four months. The Officers' course is slightly more technical and is laid out with a view to its practical value to the pilot and executive. The work is carried on in two reconstructed Mess Halls and on a large Machine Gun Range. A synonpis of the course follows:

1. Marlin Aircraft Gun.
   (a) Nomenclature.
   (b) Practical shop work.
   (c) Range Work.
   (d) Stoppages and jams.
   (e) Cleaning and maintenance.
2. Lewis Aircraft Machine Gun.
   (Same as with Marlin.)
3. Browning Aircraft Machine Gun.
   (Same as with Lewis.)
4. Fire Controls Gears and Ring Sights.
   (a) C. C. Fire Control Gear.
   (b) Nomenclature.
   (d) Maintenance.
   (c) Practical shop work.
   (e) Timing of gear.
5. Nelson Fire Control Gear.
   (Same as with C. C. Gear.)
6. A large proportion of the work on fire control gears is used for the repair and field maintenance of these gears.
   (a) Ring sights.
   (b) Method of mounting, base sighting and checking alignment.
7. Wind Vane Sight.
   (Same as above.)
8. Explosives, ammunition testing, pyrotechnics.
   (a) Testing cartridges.
   (b) By weight.
   (c) By length.
   (d) By diameter.
   (e) For thickness of rims.
   (f) Kinds of cartridges.
   (g) Their use.
9. Parachute flares.
   (a) Wing test flares.
10. Bombs.
    (a) Bomb releases, sights, fragmentation bomb.
    (b) Mark II, A and B—operation, packing, precautions in handling and assembling, nomenclature, detonator.
    (c) Safety Spring.
    (d) Safety wire.
11. Mark I and III.
    (a) Demolition bomb.
    (Same as above.)
12. Bomb Release Mechanism.
13. Bomb Sights.
14. U. S. Rifle Calibre No. 30.
15. U. S. Pistol Calibre No. 45.
16. Camera Gun.
17. Two Weeks of Advanced Training.
    (a) Gun testing mounting final adjustments.

It can be seen that the course is complete in every detail. It is equipped with a capable corps of instructors, headed by Lieutenant Owen E. Spruance, Director, and Master Sergeant Holtzman, Senior Instructor. Lecture rooms are especially well equipped. A good part of instruction is given by means of cutaway guns so that the operation of each part can be very easily studied. The work is presented in the simplest possible manner, and is a great benefit to any man taking the course as well as to the service.

Air Service Officers Receive Certificates of Mention from R. A. F.

Six Air Service Officers have been accorded Certificates of Mention from the Royal Air Force of Great Britain, as follows: Lieut. Artemas L. Gates, D. F. C., 1st Lieut. August L. Grimme, Lieut. Charles F. Heater, D. F. C., Lieut. David S. Ingalls, D. F. C., Lieut. Sherwood Hubbell, 1st Lieut Sidney R. Simmons.

Weeks Directs Mitchell to Continue Air Work

Washington.—Secretary of War Weeks has settled the controversy between Major General Charles T. Menoher, chief of the army air service, and his principal assistant, Brigadier General William Mitchell, whose removal was requested in a communication presented to the War Secretary June 8, by directing each of the officers to continue his present functions without further friction.

In a statement announcing his action, Secretary Weeks disclosed that General Menoher withdrew his recommendation for General Mitchell's relief. The War Secretary's announcement shows that he regards General Menoher as the head of the air service and responsible for all policies in that department. The actions of General Mitchell against which General Menoher complained are not disclosed in Secretary Weeks' announcement, which contains a caution to General Mitchell that they be not repeated.

In announcing his solution of the squabble between the two air officers Secretary Weeks said:

"The recommendation made by General Menoher in this matter was based upon reasons submitted with the letter which, in the opinion of the Secretary of War, justified his action. The Secretary, however, believing that in the interests of the air service and of the government itself such action would be undesirable and unfortunate at this time, has been able to secure a satisfactory adjustment of the difficulties involved."

Signal Corps Examination

A competitive examination will be held beginning August 22, 1921, for appointment in the grade of Second Lieutenant, Signal Corps, Regular Army. Applicants for appointment must fulfill the following conditions:

Candidates must be graduates, or members, of the senior class of educational institutions maintaining four-year courses of instruction in electrical engineering and physics and conferring the degree of bachelor of science in these two courses. Upon receipt of reports of examining boards decision will be made by the Chief Signal Officer as to whether or not the institution and the course therein qualify for appointment in that branch of the service. The following will not be required to take any special examination, but will be required to submit satisfactory evidence of graduation and degrees and recommendations from employers or individuals with whom they have been associated since graduation:

(1) Graduates who have graduated within four years of the date of examination and who have a bachelor of science degree in electrical engineering.

(2) Graduates who have graduated within four years of the date of examination, who have a bachelor of science degree in physics and who have majored in electrical subjects.

(3) Graduates who have graduated more than four years prior to the date of examination, who have a bachelor of science degree in electrical engineering and who have been employed in electrical industries.

(4) Graduates who have graduated more than four years prior to the date of examination, who have a bachelor of science degree in physics, who majored in electrical subjects, but have not been employed in electrical industries.

(b) The following will be required to take a special examination in one of the following subjects elected by them—electricity and magnetism; telephone and telegraph engineering; radio engineering:

(1) Graduates who have graduated more than four years prior to the date of the examination and have received a bachelor of science degree in electrical engineering, but who have not been employed in electrical industries, and similar graduates who have received a bachelor of science degree in physics, who majored in electrical subjects, but have not been employed in electrical industries.

(2) Members of the senior class in good standing who will graduate within six months and the quality of whose work is such as to place them in the upper fourth of their class of educational institutions maintaining a four-year course of instruction in electrical engineering and physics and conferring the degree of bachelor of science in these two courses.

All persons coming under the above qualifications who desire to make application for commission in the Signal Corps will do so on application blanks which may be obtained by request from the Commanding Officer of the military post or station nearest their places of residence."

Full particulars relative to both the preliminary and final examinations may be obtained by writing to the Commanding Officer of the nearest military post, or direct to the Chief Signal Officer of the Army, Washington, D. C.

Flying Field at Oakland City

We are in receipt of a letter from Joe Walker, manager of the Oneal-Walker Aerial Service, in which he informs us that a landing field has been established at Oakland City and cross-country pilots are invited to make full use of it.

The Oneal-Walker Company are engaged in advertising, passenger-carrying and photography work.

FOREIGN NEWS

Paris—Amsterdam—Paris in Less than Six Hours

A French twin-engined machine, piloted by Landrin, and having as passengers a party of journalists, is said to have made the journey from Paris to Amsterdam and back in 5 hours 50 minutes, taking 3 hours for the outward journey and 2 hours 50 minutes for the return trip.

The Andes Flown Again and Filmed

It would appear to be ultra-fashionable to fly the Andes just now. The latest to achieve the flight is reported to be Major Jack Sison, formerly Royal Air Force, now sub-chief of Peruvian Military Aviation, who left Maranga aerodrome at 12:30 on May 19, flying a Bristol fighter, *en route* for Cerro de Pasco, accompanied by J. M. McGarrigle, a cinematographer. He passed Morococha at 2 p. m. and landed safely at Cerro de Pasco shelter at 2:35.

Indian Ruler's "Handley Page" Aeroplane

The large Handley Page aeroplane which was imported from England a few months ago by the Ruler of Morvi has been erected at Karachi under the supervision of Major Duguid, who took it to Morvi on Tuesday morning, April 12, arriving there in three hours and forty minutes. The journey was accomplished at a speed of slightly over 76 m.p.h.

Commercial Aviation in Queensland

By means of aviation the railheads of Central Queensland are being linked up with the far western centers of the State, most of the work being done by the Queensland and Northern Territory Aerial Service, Ltd. This company has just introduced the first commercial triplane ever seen in the Commonwealth. The machine is provided with a comfortably fitted enclosed cabin, with accommodation for four passengers, who are protected from the weather and most of the noise. The power is supplied by a 160 h. p. Beardmore engine, and a speed of 90 m.p.h. is attained.

The Pescara Helicopter "Flies"

From Barcelona it is reported that the Pescara helicopter has been tested in the garden of its inventor. Although weighing a matter of 880 kilograms (1,760 lbs.), and having an engine of 120 h.p. only, the machine is said to have risen easily, and to have remained at a height of one foot for a considerable time. One presumes that the height attained does not represent the ceiling of the machine, but that she was kept there by anchoring arrangements of some sort. Later M. Pescara intends to have the machine transferred to the Barcelona aerodrome for the official tests.

British Terms for Disposal of Airships

The Air Ministry announces:

The policy announced in the House of Commons on the introduction of the air estimates to give up airships if they were not taken over by private persons for commercial purposes has been further considered, and it has been decided that unless a firm offer is received before August 1 all airship activities under the Air Ministry will be discontinued, and airships, stations and material will be handed over for disposal to the Disposals Board, as the Air Ministry does not feel justified in continuing expenditure on this service.

Neither this decision nor the previous one to discontinue the airship service of the Royal Air Force, which was arrived at after consultation with the Admiralty, should be taken as deprecating in any way the commercial possibilities of lighter-than-air craft. Both have been dictated by the urgent need for economy.

Trials to Continue

Some of the airships in the possession of the Air Ministry are employed on trials conducted by the Civil Aviation Department, some are laid up, one is partly completed, although construction work has been stopped, and one is being temporarily employed in connection with the training of the U. S. personnel for the airship which is under construction for the United States Navy. The trials will be continued by the Air Ministry until the end of July next, and it is intended, in addition to the tests which have been carried out for some months past with the test mooring mast at Pulham Airship Station, to arrange during the intervening period a series of demonstration cruises for the benefit of those who may contemplate the acquisition of the airships.

The material available under the Government offer is as follows:

1. Airships

R80, R33, R36, R37 (80 to 90 per cent. completed), L64, L71.

These airships, with the exception of the two ex-German ships, are equipped with bow mooring arrangements, and are ready to operate under commercial conditions from a mooring mast.

The two ex-German airships, although otherwise in good condition, require new gasbags, and are not fitted with bow mooring gear.

R36 is the only airship already fitted with a passenger car, but the others can be similarly equipped without difficulty at a comparatively small cost.

The performances of R36, R37, L64 and L71 on a 750-mile flight are estimated to be as follows:

	R36 & R37	L64	L71
Passengers carried	30	40	60
Freight carried	2 tons	9 tons	15 tons
Time for journey	15/18 hrs.	15/18 hrs.	15/18 hrs.

2. Airship Material

A large quantity of spare engines, fabric, gasbags, station equipment, and general spares and stores for the above airships.

3. Airship Stations

Cardington.—This station, which is situated about 3 miles from the town of Bedford, has all the necessary equipment and plant for the construction and repair of airships.

The workshops comprise: Engineering shop, tool room, press room, etc., girder shop, woodworking machine shop, sheet metal workshop fabric and doping shops, foundry, forge, smiths' shop, etc. The station has excellent railway and other communications, and is supplied with electric power. An up-to-date hydrogen plant is installed, the capacity of the gas-holders being about 1,000,000 cubic feet.

There is one airship shed sufficiently large to enable a ship of the latest type to operate. In certain conditions two ships can be housed therein.

Other works on the station include a W/T installation, meteorological hut, garage, store accommodation, offices, etc.

The aerodrome covers an area of 1,064 acres, of which 45 acres are occupied by the shed and buildings, and in addition there is a model village adjoining the site, which accommodates 150 families.

Skilled labor is readily obtainable in the neighborhood of the station.

This station would form a valuable asset to a commercial company. The ease with which it can be reached from London makes it a convenient site for an operation base, and its workshops make it suitable for a repair depot.

It would, however, be necessary to erect a mooring mast.

Pulham, Norfolk.—This station, which is about 16 miles south of Norwich, is equipped as an operation base. It is complete with a large gas plant (capacity of holders over 1,500,000 cubic feet), power plant, repair workshops, wireless station, meteorological hut, etc.

A standard gauge railway track runs on to the site from the Great Eastern Railway.

There are two rigid airship sheds, capable of housing three ships of the latest type. There is an operational mooring mast 100 feet high on the aerodrome.

The area of the aerodrome is 920 acres, of which the sheds and buildings occupy 56 acres.

Hut accommodation exists on the station for several hundred men.

Overseas Base—A shed 800 feet long and all necessary equipment are in existence (in this country), and are available for the erection of a base overseas.

The Government's Offer

Before receiving a concrete proposal it is not possible for the Air Ministry to state definitely the detailed forms on which the material referred to above would be made available for a company, but the following would form a basis for discussion:

The Government would—

(a) Hand over *free* the R80, R33, R36, R37 and the ex-German airships L71 and L64 as they now stand.

(b) Hand over *free* all other airship material such as equipment, stores, plant, and spares appertaining to airships and airship stations, including any German airship material received under the terms of the Peace Treaty, and the shed and equipment for an overseas base mentioned above.

(c) Place at the disposal of the company all available technical airship information and data.

(d) Place at the disposal of the company all pertinent information in the possession of the Air Ministry in wireless telegraphy, meteorology, etc., and the results of airship experimental work.

(e) Second (lend) to the company for a limited period such specialist airship personnel (to be paid by the company) as the company may require to operate and maintain the material taken over.

(f) Sell or lease to the company, on terms to be agreed, Cardington and Pulham Airship Bases complete, with all equipment, stores, and plant as they now stand.

The Requirements of the Government

The Government would require from any company accepting the above terms an agreement that—

(a) The capital of the company will be controlled by British shareholders.

(b) The Air Ministry will be represented on the Board of Directors.

(c) All material will be utilized for the development of airship transport.

(d) None of the material handed over (without consideration) by the Government will be disposed of by sale or free gift, except by permission of the Government.

(e) In the event of the company going into liquidation, and being still in possession of the Government assets so handed over, the market value of such assets over and above any capital loss sustained by the company will revert to the Government, if the Government so desire.

AIRSHIP PERFORMANCE TABLE

Ship	R-33	R-80	R-36 and R-37	L-64	L-71
Overall Dimensions:					
Length	639 ft. 5 in.	535 ft.	672 ft. 2 in.	642 ft. 6 in.	743 ft.
Diameter	78 ft. 9 in.	70 ft.	78 ft. 9 in.	78 ft. 5 in.	78 ft. 6 in.
Height	91 ft. 7 in.	85 ft.	91 ft. 7 in.	......	90 ft.
Volume of Capacity	1,958,600 c. ft.	1,200,000 c. ft.	2,101,000 c. ft.	1,972,000 c. ft.	2,420,000 c. ft.
Total lift	59.4 tons	36.4 tons	63.8 tons	59.9 tons	73 tons
Weight of hull and fittings	36.3	21.6	37.8	23.9	28
Number of engines	5	4	5	5	6
Total horse-power	1,250	920	1,570	1,300	1,560
Maximum speed	60 m.p.h.	60 m.p.h.	65 m.p.h.	70 m.p.h.	75 m.p.h.

ELEMENTARY AERONAUTICS *and* MODEL NOTES

Model Contests for Summer Months

ONE of the principal objections to model contests in the real warm summer days is that they usually entail a good deal of physical activity on the part of the contestants. By eliminating those forms of contests which require long distance running and walking as an essential feature of the event, contests in the summer months can be made even more interesting and entertaining than the average distance or duration contest.

Several varieties of contests that can be held in rather limited fields are those for looping, controlability, circling, etc.

Looping models successfully requires more skill in handling than at first it might appear. In the ordinary pusher type models extra rubber for increased power is generally required. The front elevator plane must be given a high lifting incidence angle and it is sometimes advantageous to give the main wing a slightly negative incidence by lifting up the trailing edge. When released from the hand with a vigorous initial thrust the model can be made to perform several loops before its energy is so expended that its power will not carry it over. If the adjustment has been correct the flight will terminate in a series of "waves."

Circling contests are always interesting. They have the further advantage of terminating near the starting point. Two methods are used to cause a model to circle: One is to move the main wing more to one side of the frame than the other; another way is to wind up the rubbers on one propeller more than the other. The combination of these two methods will cause a model to circle in short radii. The winner of such a contest is the one whose model can make the most circles before touching the ground.

Controlability contests are those in which the contestants are required to cause their models to terminate their flights at predetermined spots. The model flier's ability to control his model is given a good test in a contest which requires that he make his model reach four stakes or markers set at each of the compass points in four flights from the same starting point. Great skill is required for a model flier to head his machine at the proper angles into and against the wind in reaching the markers. This contest is useful in bringing forcefully to the studious builder the varying effects that are felt by a machine cutting across the wind and heading into it in odd attitudes.

Straightaway flights of short distances to a certain point provide enough difficulties to make the event worthy of a contest. The terminating marks in all cases should be plainly visible from the starting point so that the contestants can form proper judgment of the number of propeller turns required to land their models there.

Scale model contests are especially suitable for the summer time. As these models rarely travel more than a few hundred feet, the entire flight can be observed at close range. With the long distance and duration contests usually held for scientific models, the most interesting portion of the flight, the downward glide and the landing, usually takes place at a long distance from the starting point where the spectators and judges are grouped and their interest is thereby lessened to some extent.

Notes of the Pasadena Elementary Aeronautics Club

Since its inauguration in January of this year, the Pasadena Elementary Aeronautics Club has held two very successful model contests, one for hand-launched distance and the other for "rising-off-ground" for distance. The Pasadena Club is located at the Pasadena High School, Pasadena, California.

As the club is not very far from the California Institute of Technology, it has been the fortunate privilege of the Pasadena Club members to thoroughly inspect the wind-tunnel there. Model tests in the wind-tunnel have been watched with great interest by the club members and a good deal of valuable information is gained in this way.

Professor Albert N. Merrill of the California Institute of Technology, has conducted wind-tunnel experiments and given a lecture on the forces which play a part in the science of aerodynamics. Dean Baldwin M. Woods, of the summer session of the University of California, gave a talk on the subject of "How the Aeroplane Flies" before the Pasadena Club members and many other students of Pasadena High School. These little talks and lectures are exceedingly valuable to the students and assists in making this club among the most progressive in the United States.

What was considered the greatest event of the year was the recent trip to March Field, the United States Air Service Pilots' Training School, situated at Riverside, sixty miles from Pasadena. The morning was spent in watching the planes perform their various maneuvers in flight and in inspecting the machines and activities in the long rows of hangars and repair shops. The students were invited to lunch in the mess hall and had a chance to appreciate the substantial meals served, which consisted of meat, potatoes and gravy, beans, salad, pie and many other good things which were eaten with relish. The afternoon was taken up with an inspection of the ground schools.

At March Field there are schools for radio where instruction is given in the sending of wireless messages from the ground and to the planes, from the planes to the ground stations and between the planes, so that they can be in constant touch with the commanding officer. At the gunnery school the men are taught to properly handle the various types of machine guns used in the United States Army. These guns are the American 30 calibre and the new 50 calibre Browning machine guns, the Marlin gun and two types of British Vickers guns. The other type of gun used is the American Lewis, which is nearly always operated by the observer in two-seater planes. Two of these guns are usually mounted on a "Scarff" ring surrounding the observer's cockpit. The Pasadena students also visited the School of Photography where the men in the Air Service are instructed in the taking of observation photographs from the air, of the developing and printing processes, and the art of "Mosaic" map making. The Mosaic maps are made by overlapping numerous photographs taken of a particular vicinity, arranged in such a way that they form a true scale map. This method of map making is one of the most reliable but care is necessary in taking all the photographs from the same altitude and with the greatest rapidity and uniformity to achieve the correct results. The recent new types of cameras now in use in the Air Service assure the men the best equipment and instruction in its use which is possible to obtain in no other manner.

Nearly every week since January the club has held its meetings. The last meeting of the season was held on Monday, June 6. As the club is associated with the Pasadena High School, its regular activities are, of course, suspended when the school vacation begins and will be resumed when school work starts again in September.

A few of the members are planning to build a man-carrying glider during the summer. In this work the boys are to be assisted by Professor Merrill, whose practical experience in the construction of man-carrying gliders dates back to the time before the Wright brothers started their famous and historical experiments at Kitty Hawk.

3-foot turn tractor biplane model built by Jack Clark, President of the Portland Model Aero Club

Co-liperation

Magazine Editor — Are your clever verses "The Kiss" original?

Blushing Young Poetess — Not quite. "The Kiss" was a collaboration.

—*Pittsburgh Dispatch.*

"My heart is with the ocean!" cried the poet rapturously.

"You've gone me one better," said his sea-sick friend, as he took a firmer grip on the rail. —*Princeton Tiger.*

Saved By Mail

Poet — Dear Editor: What about my poem "Why Do I Live?"

Editor—You live, Augustus, because you sent it by mail.

—*Vaudeville News.*

Stage Manager—There is one thing I would like to know about this photograph of a drinking scene in the play.

Photographer—What is that?

Stage Manager—Was it made with dry plates?

—*Baltimore American.*

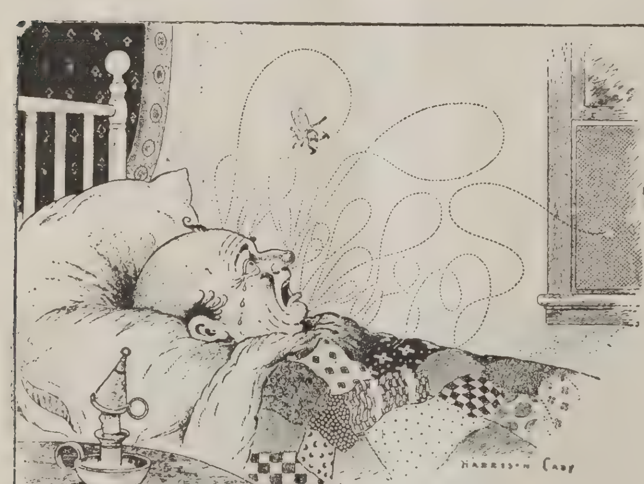
An ensign in a boarding house
  Did live; he was a bear
At looping loops and making dips
  And other stunts "up there."

The boarders in the boarding house
  Begged hard to take a ride;
And so he took a ton or two
  And tucked them safe inside

The fuselage. One of them asked,
  "What if the thing breaks down?"
The pilot said, "If so, we'll make
  For San Diego Town."

Just then a mischievous young Miss
  Fooled with the dual control;
That plane did several kinds of tricks
  Not entered on the "roll."

"Come in, come in, fair pilgrims all,"
  Saintly Saint Peter said;
"But tell me, each and every one,
  How came ye to be dead?"



WAR NOTE

IN THE EARLY HOURS OF THE MORNING ONE OF OUR AERIAL SCOUTS SUCCEEDED IN OCCUPYING SEVERAL PROMINENT POSITIONS ON THE ENEMY'S FRONT. HE WAS FINALLY FORCED TO RETREAT, BUT SUCCEEDED IN HARASSING THE ENEMY. (*Dotted lines show strategic moves used by Brigadier Fly in the above engagement.*)

They all replied, except one maid,
  Who hung her head—ah, well,
She lingered while the gate clanged to,
  And—(please fill in the rest to suit yourself, dear reader).

In the Summer

She—Gee, it's hot! I believe I'll take off my coat.

He—I'll follow suit.

She—I think your coat will do.

—*Scalper.*

Fresh—Say, what are you following me around for?

Salty—I am breaking in a new pair of shoes and they pain me. So I wanted something funny to laugh at.

The crabby Naval officer had just been pulled out of the sea by a deck hand. He wanted to reward the gob.

"Well," replied the gob, "just don't say anything about it. My shipmates would murder me if they knew that I helped you."

Consistent

May—Weren't you angry when that cadet kissed you?

Belle—Oh yes. Every time.

—*Aeroplane and Auto Age.*

Rather Personal

Colonel Smashem was dining with some friends at a restaurant.

When dessert was served, the lady sitting next to the Colonel inquired: "Do you like bananas?"

The Colonel, unfortunately was rather deaf, and coldly replied, "Madam, I do not. I prefer the old fashioned nightshirt." —*Aeroplane and Auto Age.*

Girls Built to Specification

Thomas is a very accommodating firm. When arriving there, if you are single pass the Joiners, they will fix you up. If you do not fancy your Flapper, see the Fitters and they will reconstruct her. She can be painted to suit and afterwards welded. At the end of this process, if unsuitable, the Drawing Office will no doubt give you another type of body. When, after submitting to the Technical Department for their approbation and she is still found to be unsuitable, well you will get a fine figure for her in the Buying Office.

There was a young lady named Banker
Who slept while the ship was at anchor.
  She woke in dismay
  When she heard the mate say:
"Lift up the top-sheet and spanker."

The Navy Girl

(From the Lucky Bag of '97)

Thy face is fair;
  Thy form is rare;
None dare thy charms withstand.
  Thine eyes combine
To all outshine
  The Beauties of the land.

Sweet Navy girl
  With life awhirl
Of dance and fancies,
  'Tis thee I love
All things above;
  Why can'st thou ne'er love me?

If I might hold that hand again
  Clasped lovingly in mine,
I'd little care what others sought—
  That hand I held lang syne.

That hand! So warm it was and soft!
  Soft! Ne'er was a softer thing;
Ah, me! I'll hold it ne'er again—
  Ace, ten, jack, queen and king.

—Searchlight.

AERIAL AGE WEEKLY

OL. 13, No. 17 JULY 4, 1921 10 CENTS A COPY

Villa Nova College, Devon, Pa. Photographed by W. N. Jennings

Negativing Invasion

BLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
bscriptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIII NEW YORK, July 4, 1921 NO. 17

NEGATIVING INVASION

SAYS the special correspondent of *The Tribune,* who has been present at the target practice off the Virginia Capes:

The experiments thus far have convinced both the Navy and Army observers that unrestricted submarine warfare can never again be maintained with any degree of success and that in the future no nation can wage an offensive war across the water. The three-plane attack which the navies of the world now possess has practically eliminated the question of transports. No convoy, high officers of both services declare, can be protected against an aerial attack such as was staged against the German submarine in Tuesday's test.

Troopships of the future will be easy prey to the deadly accuracy of aerial bombers, and the consensus of opinion of observers on the Henderson is that any nation, no matter how small, can successfully resist invasion from the sea if its aircraft are concentrated on the coast and capable of operating with the accuracy and precision displayed in the two days' tests just closed.

These conclusions may seem to some too sweeping. But it will be agreed that the rapid way air bombers and destroyers sent former German submarines to the bottom is of great significance. It is true that the arranged conditions favored the attack, for the targets were anchored and the range was known. But even with a moving objective, especially as large as a transport, it seems probable that the torpedoes from the air would hit.

But maybe there is an answer to the aeroplane bomber. Heretofore inventive genius has tended to re-establish a disturbed equilibrium. It will be recalled when the submarine first appeared it was loudly said: "Behold the negation of sea power!" The world was told that no nation, no matter how powerful its fleet, could defend its commerce. And now, as in the foregoing, the aeroplane is held to have put the submarine out except for limited use. So it is not entirely safe to be dogmatic about the impossibility of preventing air forces arriving above transports.

But whatever the future, it is manifest that no nation can afford to minimize the air service. Concentration on battleships seems not only expensive but dangerous. (*Editorial in N. Y. Tribune.*)

Engineering From Aloft

THE experiment in topographical study from an aeroplane as a preliminary to a survey for railroad construction in the Philippines was a great success. The Manila Railroad Company proposes extending its line to Bayombong. This would run it through parts of the provinces of Nueva Ecija and Nueva Viscaya, both of which are thinly populated and difficult of access. Neither satisfactory maps nor comprehensive surveys were to be had.

There were three possible routes to be tested as to their relative availability by the slow and costly process of actual survey. As our military authorities are much interested in the proposed railroad extension the commanding officer readily gave his consent to the use of a Government aeroplane when the experimental observation flight was suggested.

Sitting in the gunner's cockpit of a plane the engineer, equipped with photographing apparatus, was carried over the entire territory involved. His observations resulted in the immediate elimination of two of the proposed routes and the selection of the one to which the survey will now be confined.

In one day there was thus done the work that it would have taken many months and thousands of dollars to accomplish. This method may aid much in engineering. In mountainous and heavily timbered country, as in Alaska, for example, where maps are either inadequate or non-existent, flights over proposed lines of road construction would avert many long drawn out and expensive tentative surveying efforts. Even in regions comparatively well mapped and neither so rugged nor so intricate as the Philippine territory aerial observation flights may well prove time and money savers.

(*Editorial in N. Y. Herald.*)

A Suggestion to the Jersey City Police

IT is a foregone conclusion that all roads leading to Jersey City on July 2 will carry all the traffic that they can possibly accommodate and it would be well for the police authorities to take a leaf out of the notebook of the London police department and establish a system of aerial traffic control which worked so admirably at the recent Derby in England.

A navy blimp could undoubtedly be secured for the purpose, and without doubt the New York Aerial Police would render every possible co-operation to the Jersey City police in the handling of wireless control stations.

The aerial arrangements for the English Derby were in the hands of Major Fox, of the Automobile Association, who acted in the airship as traffic controller. He was able to send down notice from time to time of the exact spots where traffic blocks occurred, so that the ground police were able to divert traffic and thus save the situation. From his view-point he was not only able to give information about the blocks, but to send down suggestions of the best routes over which traffic should be diverted. Major Fox himself is of opinion that the scheme of aerial observation is thoroughly sound, and from the result which attended his labours as the first aerial traffic controller it certainly appears that his opinion is right.

THE NEWS OF THE WEEK

ZR-2 Carries 48 on First Test

London. — The giant navy dirigible ZR-2, known until recently by her British builders as the R-38, took the air for the first time on the evening of June 23. A test flight of siv and a half hours' duration was made with forty-eight passengers, and was pronounced completely satisfactory by the Air Ministry. The craft's engines, which will get their big test when the American crew that has been brought here flies her across the Atlantic this summer, previously had been worked out in the construction shed and all details found perfect.

Commander L. H. Maxfield, head of the American crew, was one of the passengers on last night's flight. The airship returned to the Cardigan hangar at 4 a. m. June 24.

Kansas-Nebraska Meet

An aviation tournament will be held at Nelson, Nebraska, July 14, 15, 16.

The business men of Nelson are backing this enterprise to a man and they have raised a handsome sum to finance it. A number of valuable silver loving cups will be awarded to winners of the various air contests. The flyer covering the largest number of miles in coming to this meet will be awarded a special trophy.

The executive committee consists of F. E. Bottenfield, I. J. Wehrman, and J. E. Portwood and the secretary is F. A. Scherzinger.

Oregon Aeronautic Board

Salem.—Appointments to membership on the Oregon State board of aeronautics, created by the last legislature, were announced by Governor Olcott June 17 as folows:

Archie F. Roth, Portland, for the five year term; Walter E. Lees, La Grande, four year term; L. B. Hickman, Portland, three year term; Leo G. (Mike) Devaney, Roseburg, two year term; Floyd Hart, Medford, one year term.

The law creating the board provides that the members are to be, so far as possible, persons who have either been commissioned, warranted or appointed aviator pilots in either the army, navy or marine corps of the United States.

The board is required to meet for the purpose of conducting examinations on the second Tuesday in April, May, June, July, August and September of each year at such places as the board shall designate and at such other places and times as the board shall deem necessary.

The law further provides that it shall be unlawful for any person to operate or fly aircraft of any kind in this state unless he holds a certificate of registration issued by the Oregon state board of aeronautics or a federal board or department established by congress.

It is believed that this law will not affect the forest patrol service, carried on by the aviation department of the United States government.

It specifically states that its provisions shall not apply to military or naval aviators while in the service of the United States or this state nor shall it apply to aircraft owned by the United States government or the state of Oregon or to unlicensed civilians when accompanied by a person licensed under the act or by a military aviator.

Aviation Bazaar in Chicago

A gala bazaar will be given by the Aviation Club of Chicago for the benefit of the unemployed ex-service men, soldiers, sailors, marines and aviators, and will be held upon the roof garden of the City Hall Square Building where our club rooms are located.

Among the numerous features of this celebration there will be a Beauty Contest in which the "Queen of Aviation" will be chosen, and five or more couples will be wedded in the air, at an altitude of 10,000 feet in a six-passenger ship. The ship and a flying chaplain will be furnished by this Club.

The Flying Field will be opened at the termination of the Bazaar. The Field is located at Dempster St. and the North Shore Channel, just west of Evanston, and easily reached within 40 minutes from the city by surface or elevated lines, or by water along Lake Michigan and up the Channel. Two boats, "Industry" and "Chicago Aviation" each with a capacity of 20 passengers will ply between the Municipal Pier and Lincoln Park Landing to the Field.

New Air Mail Head

Washington.—Carl F. Egge, of Minneapolis, has been appointed General Superintendent of the Air Mail Service, effective at once, Postmaster General Hays announced.

He succeeds Major E. C. Zoll, resigned. Since the establishment of the Air Mail Service, Mr. Egge has been Superintendent at Minneapolis where he also performed the duties of superintendent of air mail transportation. He has been in the mail service twenty years.

Leaps From Ship in Midair to Keep His Appointment

The man who was crossing the ocean and wanted the captain to stop the ship so he could get off and walk had nothing on Air Commodore E. N. Maitland, who, while a thousand feet up in the air aboard the airship R-33, suddenly remembered that he had an appointment below and so jumped out. His orderly, seeing his chief go, also jumped, and then Maitland's luggage was sent floating after them by the crew of the big dirigible.

A watchman at the Royal Airship Works at Cardington was astonished while going his rounds to see three mysterious parachutes float down and land safely in a wide field.

Commodore Maitland had seen the running of the English Derby from aboard the R-33 and afterward watched the crowd disperse from Epsom Downs. Then he turned the big airship north toward his home in Howden. As he passed over Cardington he recalled that he had promised to attend an important conference there early that same morning. The airship could not land there and Commodore Maitland could not get back to the conference in time if he continued on to Howden. Therefore, he jumped with a parachute. His orderly followed, landing close to him, and his luggage landed a minute later, all within a radius of a couple of hundred yards.

Additional World Commissioners

The Worlds Board of Aeronautical Commissioners, Inc., has been increased to ninety-six members in seventy-nine countries and colonies by the addition of Mr. E. J. Partridge, Editor of the *Guardian*, Trinidad, B. W. I., and Capt. William Bowring, Barbados, B. W. I.

Night Air Patrols to Combat Forest Fires

Calgary, Alta.—Aircraft patrolling the clouds in the dead of night will defeat forest fires in the great reserves of Western Canada this year. A squad of planes have been obtained by the Dominion Forestry Branch. Two main flights will be made daily over the southern Alberta districts. Enough night pilgrimages will be made to spot the smallest outbreaks of fire. These flights are made in the timbered foothills of the Rocky Mountains west of the rich agricultural country of southern Alberta, now being rapidly settled. Besides adding protection to the forest products, the new aerial patrols will minimize danger of fire in the vast grazing sections of the reserves, where thousands of heads of cattle and sheep feed.

Aircraft patrols have been started by the Government in other forest districts. Forestry reports showing Canada has 225,000,000 acres of merchantable timber declare that the annual loss is being greatly reduced through aircraft service.

Canada's total timber resources, experts say, amount to 3,279,000,000,000 feet. Total capital invested in the timber industry is placed at $180,017,179. Pulpwood forests, it is estimated, cover 350,000 square miles and represent 901,000,000 cords. It is figured that the supply at the present rate of destruction would last sixty-two years.

Physician Travels by Aerial Mail

Second Assistant Postmaster General Shaughnesy has just received a report of the use of an air mail plane to carry a physician and medical supplies across the bridgeless and flooded South Platte River at North Platte, Nebr., to save the life of a woman dying at a farm house two miles on the other side of the river.

The local physician, Dr. Selby, had 'phoned to all towns in a radius of twenty miles of North Platte, to determine if possible whether he could cross or ford the river at these points, but all bridges were washed out. The local air mail people took the responsibility of carrying the physician which has been approved at Washington. Pilot Smith took the doctor across without any mishaps or trouble of any kind and returned in 21 minutes.

The Superintendent's report says: "At 3.20 p.m., June 13th, I received a radiogram from the Manager of the Air Mail Field, North Platte, stating that the bridge over the South Platte River, at that point, had been washed out at two o'clock that afternoon; that there was no method of crossing the river; that a woman was dying at a farm house two miles on the other side of the river and an immediate operation was necessary to save her life. In reply to this radiogram I stated that authority for such use should come from Washington but that if it was a case of life and death, with positively no other means of crossing the river, I would grant permission to use mail plane to cross the river with a physician, but would hold the pilot and manager strictly responsible for the safe return of the plane. The plane left the field at 4:07 and returned at 4.28, time elapsed, twenty-one minutes.

Planes Urged to Hunt for "Vanished Fleet"

Washington.—Aeroplanes may be called upon to solve the mystery of the "vanished fleet."

Officials of the Department of Commerce are considering asking the army or navy for planes to patrol the little frequented stretches of coast near Cape Hatteras for some trace of the merchant vessels which have mysteriously vanished there.

Bleriot in America

Louis Bleriot, the well-known French aviator and constructor, arrived in New York on the liner *Paris* on June 22nd. He predicted the day to be not far distant when one will be able to leave Paris in the morning in an aeroplane, lunch in New York and have dinner that evening back in Paris.

"The main difficulty in the way of this achievement is to perfect a motor that will function at an altitude of 15,000 metres, at which height it is possible to attain a velocity of 700 kilometres an hour," he said. "Added to this is the simpler problem of providing compartments containing the necessary atmosphere for passengers during the journey through the high altitudes. These difficulties will be overcome; it is a mathematical certainty."

Buffalo School Opens

The flying school operated by the Buffalo Aircraft Corp. of Buffalo was opened for the season's work on June 15. A substantial number of pupils have been enrolled and an active season is contemplated.

The officers of the corporation are as follows: President, Geo. A. Moore; Vice-Pres., A. Harold Farrington; Secy. and Treas., Hugo M. Echterling; Business Manager, Elmer P. Morris.

Transient aviators are invited to make full use of the field.

Aeromarine U. S. D. Engine Completes Test

The Aeromarine, Type U. S. D., 8 cylinder engine has just completed a successful 50-hour test by the Engineering Division at McCook Field. This engine has a bore of 4¼", a stroke of 6½" and a total piston displacement of 738 cu. in. The weight is 567 pounds dry. The normal power output is 190 horse-power at 1750 R. P. M. but the engine will be choked down to 160 horse-power at 1600 R. P. M. for training purposes. This engine possesses several original features of design. The water jackets of the two cylinder blocks are cast integral with the upper half of the crankcase. The cylinder sleeves are steel tubes which are inserted in the jackets from the top. A removable head is used for each cylinder block consisting of an aluminum casting with cored water passages and steel inserts for the valve seats. The removable head will, undoubtedly, prove a great convenience in the maintenance of this engine, as it can be removed for valve grinding in a very few minutes. It will also be possible to remove the head and replace it with another in which the valves have been ground without removing the engine from the aeroplane or keeping the aeroplane out of flying condition for more than two hours.

Transatlantic Passengers Use French Service

The new Paris-Havre passenger air service seems likely to beat all records for popularity. It was instituted only last week with the object of making a quick trip to and from Paris for transatlantic passengers.

On the first occasion a trip was to be made from Havre, a wireless message was sent asking if anyone on board an incoming liner wished to travel to Paris by air. For the seven places on the aeroplane there came back at once 150 applications for Americans wanting to get to Paris in a hurry.

Aerial Honeymoon

Miss Dorothy Currie Harris, daughter of Mr. and Mrs. Frank Harris of 974 Brooklyn Avenue, Brooklyn, a student of aviation, and Russell F. Holderman of 679 East 179th Street, the Bronx, were married recently.

Mr. Holderman is Superintendent of the United States Mail Field, Queens, L. I. It had been planned to have the Rev. Kelvin W. Maynard, the "Flying Parson," perform the ceremony, but he is in North Carolina on a speaking tour, and could not officiate. The couple left in an automobile after the ceremony and reception and flew to Atlantic City and other points south. The bride has already made several short flights.

UNITED STATES POST OFFICE DEPARTMENT—AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, May, 1921

DIVISION	Gasoline	Grease and Oil	Repairs and Accessories	Miscellaneous	Motorcycles, Trucks	Rent, Light, Fuel, Power, Telephone and Water	Office Force and Watchmen	Warehouse	Pilots	Mechanics and Helpers	Radio	Departmental Overhead Charge	TOTAL	SERVICE AND UNIT COST				
														Gallons of Gasoline	Total Time Run	Total Miles Run	Cost per Hour	Cost per Mile
															hr. min.			
New York-Washington..	$1,566.15	$313.29	$629.59	$686.29	$685.87	$568.69	$1,312.12	$264.88	$1,126.96	$1,567.18	$671.05	$214.69	$9,606.76	4,621	159 00	12,951	$60.42	$0.74
St. Louis-Twin Cities..	3,265.15	914.03	2,578.60	1,806.43	876.21	307.91	2,372.05	794.64	3,405.19	3,008.71	2,013.16	644.08	21,986.16	9,158	358 38	29,778	61.32	.74
New York-Cleveland....	3,071.40	604.16	1,700.15	1,346.34	836.02	407.58	1,822.48	599.76	2,261.27	2,600.55	1,342.11	429.39	17,021.21	8,614	274 38	25,191	61.98	.67
Cleveland-Chicago.....	2,398.27	663.28	732.23	660.71	817.19	202.77	1,455.91	397.32	1,832.04	1,620.16	1,006.58	322.04	12,108.50	6,505	201 36	17,739	60.06	.68
Chicago-Omaha......	3,193.56	633.51	890.00	1,134.02	591.38	149.78	1,294.35	529.76	2,445.13	1,738.70	1,342.10	429.39	14,371.68	8,576	256 21	23,960	56,04	.60
Omaha-Salt Lake....	5,108.73	1,272.12	2,479.29	2,509.71	935.57	359.28	1,723.79	1,103.67	3,869.68	2,879.38	2,796.05	894.57	25,931.84	16,670	453 52	38,261	57.12	.68
Salt Lake-San Francisco	3,149.15	470.33	*6,207.97	2,407.55	924.40	281.40	1,887.31	794.64	2,767.84	3,180.76	2,013.16	644.08	24,728.59	10,178	373 24	33,336	66.24	.74
Totals and Averages....	$21,752.41	$4,870.72	$15,217.83	$10,551.05	$5,666.64	$2,277.41	$11,868.01	$4,484.67	$17,708.11	$16,595.44	**$11,184.21	$3,578.24	$125,754.74	64,322	2,041 29	181,216	$61.08	$0.69

* Includes cost of new motor in plane No. 149.
** Includes cost of three new generators.

New York-Washington Division:
Loss on unrepairable crashes.......................... $10,500.00
Omaha-Salt Lake Division:
Loss on unrepairable crashes.......................... $10,000.00

Total Cost—Crashes.......................... $20,500.00
Total Operating Costs.......................... 125,754.74
Grand Total.......................... $146,254.74

Overhead consists of:
Office force and watchmen; Motorcycles and trucks; rent, light, fuel, power, telephone and water; radio.
Flying consists of:
Gas, grease and oil, and pilots.
Maintenance consists of:
Miscellaneous, mechanics and helpers, repairs and accessories and warehouse.

COST PER MILE			
Division	Overhead	Flying	Maintenance
New York-Washington......	$0.27	$0.23	$0.24
St. Louis-Twin Cities........	.21	.25	.28
New York-Cleveland........	.19	.23	.25
Cleveland-Chicago..........	.21	.28	.19
Chicago-Omaha..........	.16	.26	.18
Omaha-Salt Lake..........	.18	.27	.23
Salt Lake-San Francisco.....	.18	.19	.37
Entire Service..............	.19	.24	.26

E. H. SHAUGHNESSY, Second Assistant Postmaster General.

The AIRCRAFT TRADE REVIEW

Permanent Aerial Policy Urged

Fifty men prominent in the manufacturing and operating end of aviation in this country have signed a petition to President Harding requesting that Herbert Hoover, Secretary of Commerce, be empowered to appoint an aviation commission which shall untangle and remove numerous aeronautical difficulties under which flying in this country is now pinned to earth.

The action was taken by the fifty executives—who include such men as Glenn H. Curtiss, Maurice Cleary, governing director of the Aero Club of America; S. S. Bradley, manager of the Manufacturers Aircraft Association; F. B. Rentschler, president of the Wright Aeronautical Company, and others—in order that the President might be reminded directly of what they believe is the greatest barrier ahead of aviation in the United States—uncertainty.

The aviation commission desires official sanction to make a report to the President covering the views of aeronautical leaders here concerning a policy dealing with America's future in the air, a general plan which the Government might follow in developing civilian aviation, and suggestions for aerial laws, air routes and terminals.

Following is the brief presented to the President:

The undersigned, while acknowledging the efforts which have been made by governmental departments to evolve an aeronautical policy, feel, nevertheless, that neither the President nor Congress has received from civilian aviation outside these governmental agencies, what it regards as most necessary for its immediate aid and future usefulness.

We, therefore, request the President to make available for general consideration the best opinions of civilian aviation experts not in the employ of the government. To do this it is earnestly recommended that he direct the Secretary of Commerce to appoint an Aviation Consulting Board or an Aviation Commission consisting of two civilian representatives from, and designated by, each of the following organizations:

1. Aero Club of America—representing operation, design and construction.
2. Manufacturers Aircraft Association.
3. National Aircraft Underwriters Association—representing insurance.
4. Society of Automotive Engineers—representing engineers.
5. National Advisory Committee for Aeronautics—technical.

We suggest that this group be requested to present for the consideration of the President, through the Secretary of Commerce, a report dealing with the subject of civilian and commercial aviation, with particular reference to the following matters:

1. The general policy which the government is to follow in developing civilian aviation.
2. Suggestions for aerial law.
3. Air routes and terminals.
4. Any other aspects of aviation which the committee believes should be called to the attention of the President.

As this subject is now before Congress, we urge—if the above meets with the President's approval—that the committee be instructed to report at the earliest possible moment.

Airscape of the Aluminum Castings Co., Buffalo. Photographed by the Aerial Photographic Company of America

McGraw Aviation Company Organized

The McGraw Aviation Company has been organized in Dallas, Texas, and has leased a landing field within the city limits. The company will engage in aerial transportation, flying instruction, aerial photography, etc. The field is in charge of Pilot McGraw, former Army pilot, at Mitchel Field, and is under the supervision of the southern branch of the Curtiss Aeroplane and Motor Corporation, which furnishes inspection.

Aeronautical Safety Code

On May 13 a conference was held in Washington to consider the development of an Aeronautical Safety Code for which the Bureau of Standards and the Society of Automotive Engineers have been designated as the joint sponsors by the American Engineering Standards Committee. This conference was attended by representatives of the War, Navy, and Post Office Departments, the National Advisory Committee for Aeronautics, the National Safety Council, Manufacturers' Aircraft Association, and the Insurance Underwriters, as well as representatives of the two sponsors and the American Engineering Standards Committee.

It was the sense of this conference that a safety code ought to be developed without delay and that a committee should at once be formed which would include representatives of all organizations interested in this subject as well as those which were present at the conference. Invitations have, consequently, been extended to other interested organizations.

Aerial Delivery

The Stevenson Overall Co. of Portland, Ind., whose product is designated "Aero" Overalls, is living up to its name by making a substantial number of its shipments by the air route. They are finding the advertising prestige of this new venture of tremendous value to their company.

Secretariat Gets Aerial Agreement

Geneva.—International aerial agreements are beginning to come into the League of Nations Secretariat for registration. Franco-British and German-Swiss air conventions have been received. They are almost identical in their principal provisions. Both apply only to private and commercial craft.

The governments interested reserve the right to prohibit circulation in certain areas for military reasons and the agreements provided that any aircraft finding itself accidentally over such areas must at once give the signal of distress provided for in the air navigation regulations of the country over which it is flying.

Passengers are required to have the usual papers for international travel and all goods carried must be accompanied by bills of lading. Certain aerodromes are specified as the only points from which aircraft may start and land. Machines must carry certificates of "airworthiness," and marks of identification must be sufficiently plain to be easily recognized during flight.

AERIAL PHOTOGRAPHY AND ITS APPLICATION TO MODERN INDUSTRIES

By F. E. HAGGVIST

[*Mr. Haggvist is a graduate of the Massachusetts Institute of Technology, and during the late war was Photographic Officer in charge of the photographic laboratory at the U. S. Naval Air Station, Pensacola, Florida, the Navy's largest air station in this country. He is now president of the Aerial Photographic Company of America, with headquarters in Boston.*—EDITOR.]

AERIAL photography was practically unheard of before our late war with Germany. It was one of the many assets that had its beginning and underwent development during those hard days of struggle. It was found that aerial observers could not carry back valuable information which they discovered with any degree of certainty. Photographic information concerning the enemy was the most complete and definite that could be obtained, for nothing was left to the memory and nothing was overlooked. Its value was slow to be appreciated, and it was only through the untiring efforts of those who really visualized its importance that it was considered with any degree of seriousness and developed to its present state of efficiency.

Now that the war is over, its uses are finding new fields to conquer daily. One of the most important of these is in connection with modern industries of today. An industrial plant of any size is impossible to photograph from the ground, for the reason that the structures in the foreground obscure those to the rear, so that it does not convey to the mind the entire extent of the plant. The only solution to this matter is to get a high enough viewpoint to eliminate this difficulty. Natural or artificial surroundings very seldom permit this, so resort is usually made to the aeroplane, by which it is possible to maneuver at will to the best vantage point. It is thus easy to show every building and its relative size and give a very decided impression as to the extent of the plant.

Heretofore we have had to rely on bird's-eye drawings, but due to the great number of advantages gained by actual photographs, these are rapidly being displaced. An aerial photograph represents things as they actually are—there is no guess work. It is said that the camera never lies, and it illustrates this point excellently. A great many people may not be very proud of the appearance of their plants, and probably refer a reproduction that does not show the scrap heaps about the yard or undesirable shacks put up here and there. These, however, can be easily eliminated from the photograph, or improved upon by a little retouching, and similarly, other desirables may be added, such as placing the name of the concern and their product on the roofs of the buildings.

Another advantage of the aerial photograph is that it shows a great amount of detail. Take a chemical manufacturing plant of such a nature that it has a large number of retorts, condensers, vats and pipe lines connecting these. Every one of them will be reproduced in detail. This fact is one of the reasons why an aerial photograph is so lifelike. If a person wished to convey to the public what he looked like, he certainly would not have a drawing made of himself, but he would be photographed. An aerial photograph showing smoke coming out of a stack, a freight train puffing in the yard, automobiles drawn up to the curb, people walking about, when all taken in at a glance, show signs of activity and tend to make a picture that is lifelike.

Aerial photographs are of great value to industrial concerns in many ways. By careful analysis it is possible to determine from them the proper location of new buildings to meet the requirements of future expansion. They show what relation the various units bear to one another, and the routing of material through the plant can be followed in connection with production problems. For advertising purposes there is nothing that attracts and holds a person's interest more than an aerial photograph. The majority of people have never had the opportunity of going up in an aeroplane, and they are therefore very much interested in knowing how objects on the ground appear from several hundred feet in the air. Reproductions for letterheads are now made from aerial photographs. Enlargements of good size for framing are used to advantage in the various offices of the company.

The expense of having an aerial photograph taken is much less than the cost of any other form of reproduction. Additional prints can be made from time to time as desired at a very small expense. To sum the matter up,—it is actually possible to get something far superior to anything yet produced at a smaller cost.

The largest immediate field for aerial photography appears to be in connection with mapping and surveying. Up to the present time our study of the earth's surface has progressed very slowly, for a great amount of territory has been inaccessible to observation. Land surveys in such localities which require a long time to complete and involve considerable expense, were often started in the summer and seldom completed until winter when the surface conditions were considerably changed in appearance. Also at other times the changes in water resources between the wet and dry seasons made this matter very difficult. Aerial photography will greatly eliminate the uncertain results derived by these earlier and more tedious methods. One of the most important uses of aerial mapping and surveying is in connection with large Federal and privately owned timber lands, the surveys of which never could have been completed by the earlier methods without a large expenditure of time and money. Now it is possible to do this work in a very short time, at less expense, and the results obtained far better, for these maps will clearly show the types of trees as well as their location, and also whether the sections are thinly or thickly wooded. In the future all important surveys, including such as for railroads and canals, will be preceded by an aerial survey.

The method used in making aerial maps, or mosaics, as they are technically called, is to fly at a predetermined altitude over the territory to be photographed, along certain courses which have previously been laid out. A series of exposures, taken vertically downward, are then made, the time interval between each exposure being sufficient to allow a certain overlap on each picture. This interval is determined by a calculation involving the size of the negative, the altitude from which taken, the focal length of the lens, the relative speed of the plane over the ground, and the overlap desired. The camera is mounted on gimbals in the cockpit of the plane, with

Airscape of Central Grain Elevator, at Buffalo, New York

Airscape of the Carborundum Company Plant at Niagara Falls

the lens pointing downward, the photographs being taken with clocklike precision through an opening in the bottom of the fuselage. The gimbal mounting makes it possible to always keep the lens axis perpendicular to the plane of the ground, which is absolutely necessary to eliminate distortion. The pilot's duties are to keep a constant altitude, the plane as level as possible, and to follow the courses laid out. Then the negatives are developed, and prints made from them of the same color value, so that they will blend together into one large mosaic when matched. This laboratory work requires a great deal of patience and skill.

Another large field for aerial photography is in the real estate business. The progressive realty broker or salesman of today has in his office a series of aerial photographs showing various sections of the localities which he has for sale. These are offered to the prospective purchaser for inspection, who finds it possible to tell from a single glance at these pictures the general appearance of the surroundings far better than could be told by pages of descriptive matter. The real estate agent then points out the properties for sale, their relative locations, how many blocks it is to the street car line and the railroad station, where the churches, schools, and parks are located, and the proximity of the grocery store, the garage, and the theatres. If the customer appears pleased with the general surroundings, a trip is then made to the favored section for inspecting the property itself. In this manner a great amount of time is saved by not having to take a customer to numerous residential districts only to find that the general surroundings fail to attract him. Agents handling industrial sites have an aerial map showing all the railroads entering and leaving the city and including several hundred feet of territory on either side. These sites are then blocked off, and an interested purchaser shown the relative location of any site, the nature of the property, its shipping facilities, and its distance from the center of the city. Unnecessary traveling is thus eliminated to a considerable extent. When it comes to selling farms, or large esates and similar outlying properties, aerial photographs prove themselves indispensable to the present equipment of modern real estate office.

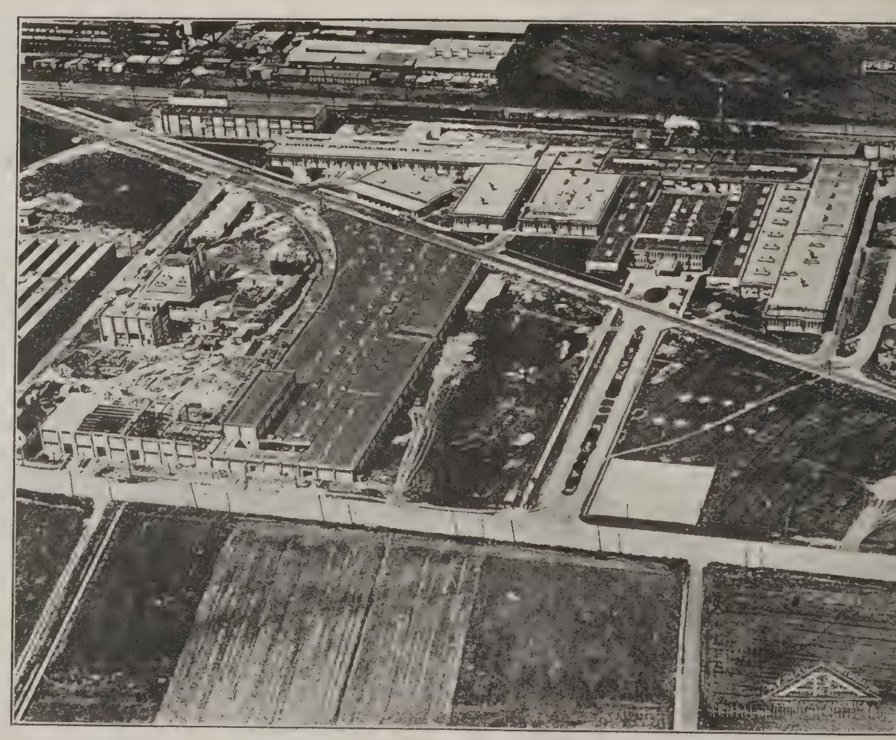
Each week now brings some new use to which aerial photography can be applied. Chambers of Commerce are fast realizing the importance of aerial photographs for advertising purposes. There is no way in which the facilities that a city may offer, especially railroads and water frontage, that can be better shown to industries that contemplate building, than by aerial photographs. They are also of grat value in solving the traffic problems of a busy community, insomuch that details of the movements of vehicles are readily recorded and points of congestion located. The planning boards of large cities find them indispensable in the determination of the best locations for cutting new thoroughfares in the newly developed sections of the city. Officials in summer resort communities, such as hotel managers, are also employing aerial photographs to show the attractiveness of their hotels and beaches and the natural environments that would appeal to the public.

The uses of aerial photography are too numerous to even imagine. It is a new industry with a future that has limits as yet unknown. While commercial mapping will be one of the important fields of the new art, advertising specialists, construction engineers and others will use aerial photography extensively in the practice of their professions to show finished developments and construction progress. The infant industry marks a big step forward in scientific achievement, and we need not doubt that future results will add impetus to the advance of civilization.

International Standardization

The Secretary of the American Engiteering Standards Committee, Dr. P. G. Agnew, has just returned from a short trip to Europe to attend a conference in London of the secretaries of the national standardizing bodies. After the conference he visited France, Switzerland, and Germany for a more detailed study of the standardization work in those countries.

Arrangements are being made for close co-operation between the national standardizing bodies and the International Chamber of Commerce, which will give special consideration to the subject of standardization at its convention in London the week of June 27, and has organized a committee to develop interest in the subject on the part of industrial and commercial interests, and for the diffusion of information on standardization. It is the policy of the International Chamber of Commerce to further the standardization movement by such means, considering only the more general aspects of the problem, and the policies to be followed, leaving the details of industrial standardization to the national bodies, who will co-operate directly with the national organizations of the International Chamber of Commerce in their respective countries.



Airscape of the Plant of the Beaver Board Company at Buffalo

THE POSSIBILITIES OF AIRSHIP SERVICES

By LORD MONTAGU of Beaulieu

THE new Secretary of State for Air, Major F. Guest, M.P., came to a wise decision when he reversed, or rather suspended for a further period, the policy of his predecessor, Mr. Winston Churchill in the matter of airships. Four months ago they had been condemned to disappear at once, for it had been decided that unless a commercial syndicate came forward to take over the existing airships and their organization everything should be scrapped and the airship department closed down on May 1. A definite reprieve, however, until August 1 has now been decided upon, and it is hoped that a group of far-seeing and enterprising commercial men may be found before then to take over the valuable plant and the four airships which have cost together so many millions, for a sum perhaps only a very small proportion of original expenditure.

As regards airships, there can hardly be any doubt that for long-distance non-stop journeys, such as England to Eygpt, to India, to the Far East, to West, East, and South Africa, airships rather than the aeroplane must eventually be the means of our conveyance. Before the end of 1918 one of our airships had spent 104 hours in the air without coming down, and everyone knows of the wonderful flight made by a German airship from Belgrade to Khartoum and back, a distance of over 2,400 miles. It is also not generally realized that over 2,000,000 miles were flown during the war by airships of different types without accident.

We have now in this country four large airships, R33 and R36 of British make, and L64 and L71 built in Germany in 1918, and handed over to us under the Peace terms, besides two smaller ships of no real value for long-distance traffic. L71 is the largest airship at present in existence, although the Zeppelin Company in Germany are designing larger types already. She could carry thirty-five passengers and two tons of mails or valuable freight, on a flight as far as from Bedford to Egypt, performing the journey of 2,500 miles in a little over fifty hours. Against this our own R36, our biggest British-built airship, could not fly with more than a ton of useful load to Egypt in about the same time. It is interesting to note in regard to L71 that the German designers and builders intended her to fly, if necessary, to Japan without a stop from Germany, and in the case of their new airships are ready to deliver them to Japan in that way.

Night Service to Paris

It may interest readers to know that to make a start it has been suggested that R36, which can take fifty passengers, and is fitted with comfortable dining and sleeping accommodation, will probably be run during the latter part of this summer between some English station, say Croydon, and certain towns on the Continent such as Paris, Brussels, or Amsterdam. It is intended also to make this service a night one, so as to provide a means of crossing when there is no other service available, leaving the neighborhood of London at 11 p.m., and reaching Paris or Brussels in the early morning so that passengers may be at their hotel for bath, breakfast, or business about 8 a.m.. But this scheme involves the erection of additional mooring masts, and it may be August before this is accomplished, although most of the material for them is in stock already. These short services are better than none, but a correct parallel would be the use of the Mauretania on a cross-Channel service. The distance is too small to be a real test.

It may be asked, why has the airship been so neglected of late, and only attention paid to the aeroplane since the war? The answer can be found in two directions. First of all, there was the expense of building sheds, which were till lately thought to be absolutely necessary for airships, a shed often costing more than the ship itself. But the mooring mast system has now superseded the need of a shed almost entirely, except for docking purposes, to use a marine term, and mooring experiments at Pulham with R33 have been so successful that it has now been established that an airship can leave and return to her moorings in practically any weather.

Germany Awaiting Her Chance

But it is not only in England that attention once more is being directed to airships. In America a company has been formed with a large capital to establish airship services between various points in the United States, and eventually with the object of linking up America with England and the Continent over the Atlantic. Again, Japan is making inquiries as to airships, while Italy is continuing the use of her successful M series, which did such good work in Tripoli in the last war there. France is spending about a million sterling this year on airship services, and, as before mentioned, Germany is only waiting until the expiration of the allotted time stipulated by the Treaty of Versailles to start airships again on a big commercial scale. It is clear, therefore, that other nations are realizing the value of the airship for commercial purposes, and the paltry quarter of a million which is all that the airship service here requires to finance its expenditure for the next six to eight months does not make a very brave show, considering the relative circumstances, alongside the efforts of other countries.

The second reason for the decline in interest in airships is to be found in the fact that the supporters of the aeroplane are severe critics of the airship. Many of these decry the possibility of its use in time of war, and to some extent there is justification for their opposition. There can be no doubt that the enormous size and inflammability of a dirigible make it an easy and vulnerable target. And the use of non-inflammable helium gas is as yet impracticable. But, after all, the Germans used airships most successfully over the North Sea, from Borkum in the southwest to the Norwegian coast in the northeast, during the greater part of the recent war, and at the battle of Jutland the escape of the German Fleet was principally brought about by the fact that, whereas it had information from airships, we had none, and while they could locate our Fleet we could not locate theirs.

There is no doubt, therefore, that airships of some sort are a necessity to a modern fleet, and even if they have to be protected by aeroplanes in the same way that battleships are protected by destroyers from submarine, that is not an insuperable objection.

Financial Points

Now let us consider a long-distance service of London to Africa and Asia via Egypt, which would really show the innate advantages of the airship. It is approximately 5,000 miles, with Egypt as a half-way house, to Karachi. The actual flying time from London to India would be about 100 hours. To this time must be added, say six hours in Egypt for examination and refilling with hydrogen and fuel, making a period of about four days ten hours, or say four and a half days. This, compared with the time taken by the fastest modern ship and train combined, of sixteen days, gives a clear saving of about twelve days. Of course, to Egypt and on to points in Asia and Africa a higher charge would have to be made for air-conveyed letters. But as over 34,000 letters of an ounce each are comprised in one ton of weight at 1s. an ounce, this would produce £1,700 revenue per ton. This is a good return for an airship carrying two tons each way, for it should be able to do the complete journey to India and back every twelve days, or about thirty journeys a year. The postal revenue, therefore, on this basis would be over £200,000 a year per airship, less Post Office charges.

To run such a service effectively six dirigibles would be needed, of which we now possess four. Two more ariships are therefore needed, which would cost in round figures £225,000 apiece. In addition to this there would have to be an expenditure in Egypt for mooring masts and bases needed of about £300,000, and at Karachi the mooring mast and certain buildings would cost about £125,000. This makes £900,000 the sum necessary to start a service to the East, with six airships with properly equiped bases, or, say, £1,-000,000 in all, allowing £100,000 for working capital which would be necessary to a company undertaking this enterprise.

Aid for Fishing Fleets

Finally, let the airplane critics, as well as the public, remember that airships are useful for many purposes for, which aeroplanes are not suitable. For the purpose of a careful survey of land or sea below, hovering or progress at a very slow speed is necessary. For instance, Fishery Boards declare that the locating of shoals of fish would be most valuable to our fishery interests and ensure a larger and cheaper supply of fish for our population here and for export. Herrings and mackerel in particular always travel in shoals, and while their supply seems unexhaustible the demand for them is immense. Then, again, there is the exploration work to be done over hitherto unexplored and undeveloped country like Central Africa, Western Brazil, Southwestern China, and parts of Turkestan and the country north of the main ridge of the Himalayas. Then there are great possibilities of surveying correctly unknown countries much more cheaply and effectively than the usual methods on foot or with animals. Investigation of meteorological phenomena will be also the easier if we can remain in the air for four or five days consecutively.

But at the moment every effort should be made to develop the commercial aspect, and considering the immense potentialities for national service of many kinds, I hope most earnestly that the Government will continue to provide for airship operations even if in three or even six months a commercial group has not been found to take over existing airships. Money is now very hard—almost impossible—to find for new enterprises, and at least a year should be allowed before any final step is taken to disband the small but magnificently keen body of experts, or to scrap over forty airships and their organization which have cost millions sterling during the last few years. (From the *London Observer.*)

HALF-YEARLY REPORT ON BRITISH CIVIL AVIATION

A Report on the progress of Civil Aviation during the period from October 1, 1920 to March 31, 1921, when civil flying in Britain passed through a difficult phase, was issued June 13 as a White Paper, bearing the signature of Sir Frederick Sykes, Controller-General of Civil Aviation.

The Report shows that, in spite of inactivity in some directions, there has in fact been a steady advance in the organization and development of civil aviation at home and abroad and that obstacles which were hampering progress are now being overcome.

The Report, besides dealing with Civil Aviation in Great Britain, describes the progress that is being achieved in the Dominions, and also, in briefer form, in foreign countries.

International. It has been arranged that the International Air Convention will be ratified by the British Empire as a whole. One of the reservations adopted by the British Empire will allow Canada freedom of action vis-a-vis the United States.

Temporary agreements for the control of air traffic have been concluded between Great Britain and Denmark and Great Britain and Sweden, and it is expected that a similar agreement will shortly be signed between Great Britain and Norway.

Periodical Civil Aviation Conferences with the French and Belgian Air authorities have been continued.

Home Regulations. New regulations have been framed under the Air Navigation Act 1920 and will be issued by Order in Council to come into force simultaneously with the International Air Convention, i. e., 40 days after the ratification has been deposited.

Organisation. Further steps have been taken to improve the General ground organisation at the Customs aerodromes at Croydon and Lympne. The installation at Croydon of a night-lighting system to permit regular night-flying on commercial services is now nearly completed, and steps have been taken to provide two new lighthouses on the English section of the London-Paris route.

The value of direction-finding and wireless communication has been proved on many occasions as the following instances show:

(a) A machine, flying from Paris to London, was told to land at Croydon owing to fog at Cricklewood. The pilot, unable to locate Croydon, requested bearings, which were given by direction-finding. The pilot landed safely, and stated that he would probably have failed to reach Croydon had he been without wireless.

(b) A machine, also flying from Paris to London, was instructed while over mid-Channel, to land at Croydon. Later this order was cancelled, and the pilot told to climb to 2,000 feet and go on to Cricklewood; he was warned to look out for a rocket, which was duly observed. Landing instructions were given and the machine landed safely in thick fog. The pilot afterwards reported that he had not seen the earth after passing Maidstone.

As a result of the conferences with the French and Belgian air authorities, details and conventional signs, required in aeronautical maps, have been agreed upon and a preliminary edition of general and local aeronautical maps has been prepared.

The distribution of meteorological information throughout the country has been developed, and an extension of the wireless telegraph facilities has been found necessary, in order to make this possible.

Commercial Services. In consequence of the suspension of the British Continental Services, a small Committee was formed in February by the Secretary of State for Air to examine the whole question of granting financial assistance to firms operating on cross-Channel services. As a result a daily service from London to Paris was re-opened on March 19, 1921, by Messrs. Handley Page and the Instone Air Line; each firm being guaranteed 10% profit on its receipts, with a maximum subsidy in each case of £25,000. The Committee is now considering a permanent scheme for the direct assistance of air services.

The recommendations of the Committee have been approved by the Air Council, and have been submitted for the concurrence of the Treasury.

It will be seen from this Report that whereas during the six months from April to Sepetember, 1920, British air traffic was about four times the foreign traffic, from the beginning of 1921 to the end of March it has been only about one-quarter of foreign traffic, the number of arrivals and departures of British aircraft to and from the Continent having fallen fram 1,997 to 644. During the period under review the machine mileage for civil aviation was 212,200 miles, the number of passengers carried 10,103 and the weight of goods 38 tons, as compared to 689,000 miles, 32,345 passengers and 86½ tons for the previous six months. It is significant that the value of imports by air has only fallen from £376,606 to £305,831, and of exports from £168,300 to £167,731.

Thus whereas from April to September 1920 British air traffic was about four times greater than foreign, from January to March 1921 it was only about one quarter of the foreign traffic. But a distinct improvement was at once recorded at the latter part of March, 1921, on the re-opening of a British service to Paris, when on an average 7 passengers per machine were carried.

Though the ratio 0.30 passengers killed per thousand carried is slightly in excess of that for the previous half-yearly periods there has been only one fatal accident during the six months under review.

Meteorology. A service of weather reports from ships in the North Atlantic commenced on 26th March. The number of distributing stations of the Meteorological Office has now been brought up to twelve by the opening of a station at the Isle of Grain. Part of the work of this station is to co-operate with the Ministry of Health in carrying out research affecting the incidence of malarial fever. New Marine agencies for organizing the collection of meteorological information from ships have been established at Hong Kong, Vancouver and Melbourne. Arrangements have been made with the Postmaster General whereby the delivery of telegrams has been expedited.

Pilots and Aircraft, Et. The licensing of air personnel and aerodromes and the registration of aircraft have procceded normally. Up to March 31, 1921, 617 pilots had been licensed and 635 heavier-than-air craft registered.

Medical Services. Medical examinations of civil pilots who have been engaged regularly on flying duty for a period of approximately 21 months indicate that the average physique of pilots regularly employed is satisfactory and that there is no deterioration as a result of constant work, but it is considered too early to ascertain whether further experience will produce similar results. Questions of medical interest are also under investigation in connection with airships, among which may be mentioned ventilation, heating, sanitation and cooking arrangements, while the effect of travel by air on the officers, crew and passengers is also being fully considered.

Information. At a Conference attended by representatives of the Colonial Office and the Dominions, it was agreed that a periodical Progress Report should be prepared by each Dominion and that such reports should be regularly interchanged. The question of collection and dissemination of aviation information concerning insurance interests has also been under consideration between the Air Ministry and the parties concerned.

Research. Investigations into the use of metals in the construction of aircraft are being continued and various new types of propellers have been tested, including variable pitch propellers, adjustable during flight, and propellers with metal hubs and detachable blades which can be set at any desired pitch before flight. In the development of engines special attention is being paid to direct fuel injection super-charging and engine starters.

It has been decided to hold an open competition, particulars of which will be published shortly, for self-sealing and crash-proof petrol tanks.

Airships. The Department of Civil Aviation has carried out

at Pulham a series of successful experiments in the handling of airships from and to a mooring mast. Between February 2nd and March 31st, 58 days, the mast was occupied on 46 days, 23 flights from the mast were carried out and the airship experienced while moored a maximum wind of 48 m.p.h. One landing at the mast by night was accomplished.

Expenditure. The vote for Civil aviation for 1921/22 amounts to One Million Pounds. Of this about £425,000 is allocated for the maintenance of aerodromes, salaries and wages, works, buildings, lands, purchase of experimental aircraft, etc., for the development of Civil heavier-than-air craft.

Although, owing to development last year being smaller than was expected, a saving of £400,000 was effected on aerodromes, communication, etc., the estimates for ground organization have again been based on the assumption that Civil aviation will considerably expand, especially with the direct assistance now granted on the routes to the Continent, and any sum less than £400,000 would leave no margin for expansion.

Imperial Air Routes. Negotiations are proceeding for the acquisition of an aerodrome site at Halfar, Malta. Arepresentative of the Civil Aviation Department visited Egypt in February to discuss questions affecting the development of Civil Aviation.

Dominions and India. In Australia, an Air Board has been established and an Air Navigation Bill and Regulations have been brought into force.

The Australian Government has appeared the operation of an air mail service, and the merits of two routes are being discussed. A private scheme for the establishment of regular air services is also under consideration.

A Canadian-Inter-Departmental Conference has been held to consider the use of aircraft for forest and fishery protection, survey and exploratory work. 7,350 miles of air routes were surveyed during 1920. The trans-Canada flight from Halifax to Vancouver was successfully carried out in October.

At the request of the U. S. State Department, the Canadian Air Board has extended for six months, until May 1, 1921, the period during which certain U. S. aircraft may be permitted to enter and fly in Canadian territory.

The Air Board of India, under the Commerce Department, is a purely advisory body without executory functions. As soon as funds are available, the Government of India has decided to prepare a trunk air route from Rangoon (via Calcutta and Allahabad) to Bombay. When this route, or a section of it, is completed, tenders will be called for an air mail service over the completed portion. Local Governments in India have also been empowered to lay out air routes within their own boundaries.

In New Zealand, contracts have been approved by the Cabinet for an ai rmail service between Aukland and Whangarie and between Christchurch and Timaru.

An Air Board has been appointed in South Africa to advise the Government on air questions.

Foreign. Part 2 of the Report reviews the air activity abroad. The most conspicuous features of the period are the increased French subsidies to air transport companies and the energy with which Germany is prosecuting air schemes with the limited resources at her disposal. Although late enemy countries are forbidden to maintain a military air force, Germany, Austria and Hungary will be permitted to retain a number of aerodromes in order to facilitate international commercial aviation.

The French Civil Aviation Vote for 1921 shows a considerable increase on that for 1920 and amounts to frs. 147,374,012, of which frs. 31,700,000 is for subsidies to air transport companies, and frs. 25,575,000 for the construction of two rigid airships, bases and equipment. Beyond this vote, frs. 4,500,000 have been voted for aviation under the Minister of Colonies. The effect of the French subsidies has been to permit the reduction of single fares from Paris to London to 300 frs., from Paris to Strasburg to 150 frs. and from Paris to Prague to 500 frs.

In 1920, 989,270 miles were flown by French aircraft as compared with 221,320 miles in 1919.

The development of aviation in the French colonies is being taken up in West Africa, Asia Minor, Indo-China, and French Guiana.

The meteorological services in France have been combined in a National Meteorological Office, which is incorporated as an autonomous department in the Civil Aviation Department.

The Belgian Government has provided about 10,000,000 francs (including frs. 800,000 for subsidies) for the encouragement of civil aviation. The Societe Nationale pour l'Etude des Transportes Aeriens, now no longer a Syndicate but a limited liability company with a capital of frs. 4,000,000, will secure the greater part of the subsidy, which is allocated on a system similar to that of the French.

A new company, the Societe Anonyme Belge de Constructions Aeronautiques, has recently been formed at Brussels, with a capital of frs. 5,000,000, for manufacturing and trading in aircraft and aeronautical material.

Meetings of the representatives of the International Air Traffic Association have been held at the Hague and at Berlin, to discuss the establishment of regular air services between the Netherlands, Paris, London, Frankfort and Bremen.

The total estimate for civil aviation in Holland amounts to fl. 715,000. The Koninklijke Luchvaarte Maatschappij is being granted fl. 200,000 as a subsidy to meet two-thirds of the Company's losses in the year 1920-21. On the Amsterdam-London service operated by this company 584 trips, covering 146,000 miles, were carried out without accident.

Civil Aviation in Germany is confined to the use of about 125 ex-military machines, with the exception of the civil type machines specified in the last report. The Government has carried out the instructions of the Inter-Allied Commission of Control by prohibiting the flight to foreign countries of any of these ex-service aircraft, but internal services have been in operation on 9 routes. Preparations are being made for a service between Munich and Lake Constance to be extended to Geneva, via Zurick, in conjunction with a Swiss Air Transport Company. The German Post Office pays a subsidy of 21 marks per km. flown on regular air lines.

The Roumanian Minister of Communications has been authorized to sign a contract with a French Company, the Franco-Roumaine de Navigation Aerienne, under which the Company has the right of air transport in Roumania on the Paris-Strasburg-Prague-Vienna, Budapest-Belgrade-Bucharest, Constantinople air route over a period of 20 years. The agreement carries with it an annual maximum subsidy of 6,500,000 lei to the Company in return for certain guarantees including the placing of its material and personnel at the disposal of the Roumanian Government in the event of mobilisation.

According to a report, a decree has been issued by the Russian Soviet Government laying down regulations for air navigation. Foreign machines may enter the country subject to application being made several days previously.

The conclusion of an air navigation agreement between the Scandinavian States has not yet materialized, although a proposal to this effect is now before the Swedish Parliament.

In Norway the Ministry of Defence has issued temporary regulations for civil aviation.

The Swedish Air Traffic Commission has submitted a consolidated report and the Swedish Government has applied for grants in aid of civil aviation amounting to 170,000 kr. for 1921, and 360,000 kr. for 1922, with, in addition, grants of 60,000 kr. and 60,800 kr. to improve the meteorological service.

A Swiss Government Order prohibits aircraft belonging to a country with which Switzerland has not entered into an Agreement, from flying over Swiss territory. An Agreement with Germany was ratified in December 1920.

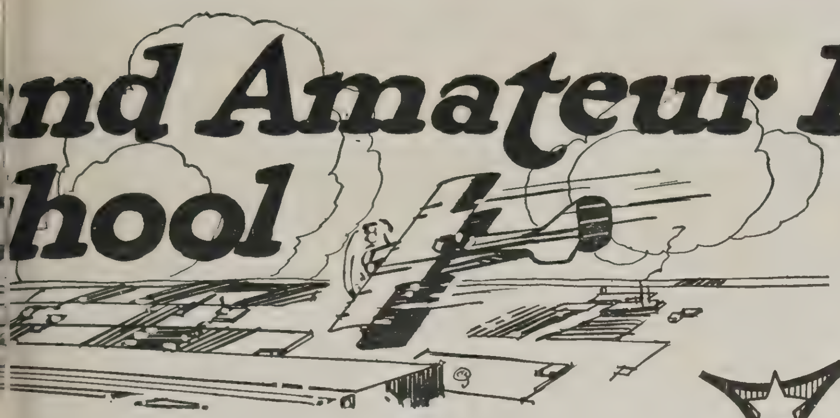
Progress has been maintained in the Eastern countries, especially in Japan, where the programme of the Air Bureau includes the consolidation and encouragement of civil aviation, the supervision of private undertakings, and the establishment of an international air route. Civilian pilots are to be trained at the Military Aviation School, 292 applications having been received for 10 vacancies available in 1921.

Among the South American States Argentina and Chile have shown notable enterprise. The Argentine Government has sanctioned the establishment of an important air mail service between Bahia Blanca and Rio Gallogos, while in Chile no less than $565,000 has been raised for founding a civil school of aviation.

The United States has not yet in existence a Government Department or organization for the control of civil aviation, nor is there a Federal law for the registration of aircraft and the licensing of personnel. To maintain the activities of the Post Office, a sum of $1,250,000 has been voted for the current year.

Appended to the Report there is a table of Continental air transport and mail services which contains full details of times of service and scales of charges on 20 air routes.

Another appendix to the report gives details of the Customs tariffs on aircraft material imported into various foreign countries.



is included and twenty-four different domestic and foreign makes are represented.

Planes, some complete with engines; sea sleds, and hangars constitute the remainder of the material offered.

Every item is of compelling interest. Representative values are given below. *Note the catalog offer.*

Spare Engine Parts and Accessories

A considerable quantity of spare parts for the engines and planes included in this sale are also offered. For complete information see catalog.

SPARK PLUGS: A large quantity of aeronautical spark plugs of leading makes.

TACHOMETERS: Hall-Scott, Warner type. About 144 are offered.

For complete information see catalog.

T War Department earnestly advises prompt action nhe part of prospective buyers as all material is ofe d subject to prior sale and all sales are by negotiaic at a fixed price.

Ft inspection privileges are allowed, in fact it is the ere of the War Department that all prospective purh ers shall inspect the material carefully. See catalog o locations and complete information.

U.S. AIR SERVICE

Sale at Fixed Prices

All the material in this sale is offered at fixed prices which are plainly stated in the descriptive catalog furnished to all interested persons. The terms of sale are in no way involved and shipments will be made promptly. The terms of sale and everything the prospective purchaser might wish to know concerning the material is covered in the catalog.

Special Prices in Quantity

On the engines offered a special price will be given on quantities and where the purchaser buys the entire lot of a certain make of engines, all the spare parts for that engine will be included in the purchase at no extra cost.

All orders, requests for catalogs or information should be addressed to:

Material Disposal and Salvage Division

Air Service
War Department
1650F Munitions Building
Washington, D. C.

IES ARMY
TICAL EQUIPMENT

THE "ZR.2"

THE "R38," which will be known in the United States as "ZR2" is now almost ready to undergo her first trials.

Next month, if her trials are completed satisfactorily, the American crew now being trained in England on R80 will take her over and fly her across the Atlantic to New York, and then across the United States to San Francisco. At full speed the ship has an endurance of 5,000 miles, so that it should be comparatively easy to make the flight successfully with only one descent at New York.

Our contemporary *Flight* describes the "R38" in its issue of June 9 as follows:

The design of "R38" was decided upon by the Admiralty in the spring of 1918, and construction was started by Messrs. Short Bros, at Cardington, in November the same year. Later, in April, 1920, when the Air Ministry took over the works, work was continued by the Ministry. "R38" is the largest rigid yet constructed in any country. Its capacity is larger by some 300,000 cu. ft. than that of the ex-German airship "L71." (See *Flight*, February 3, 1921.)

"R38" was designed for naval purposes, first consideration being given to the attainment of the greatest possible ceiling—the experience of Germany in the use of airships for scouting and night raiding having demonstrated the necessity for the ability to climb rapidly to high altitudes.

The construction of "R38" marks indeed a very definite advance in British airship practice as it is the first ship of purely British design and not merely a copy of previous German ships—if exception be made of "R80."

The story of German progress in rigid airships during the War is mainly a record of ever-increasing efficiency gained by constructional improvements to reduce weight both as regards hull and machinery, culminating in the production of the "L70" class, which was capable of rising to about 24,000 ft. The class to which "R38" belongs, and of which it was to be the pioneer, was intended to consist of four airships. Before work on them had progressed far the Armistice intervened, and the other three airships of the class were cancelled.

The main dimensions and characteristics of "R38" are as follows:

Length	695 ft.
Diameter	85 ft. 4 ins.
Capacity	2,700,000 cu. ft.
Total lift under normal conditions	83 tons
Total h.p.	2,100
Engines	6 Sunbeam "Cossacks" of 350 h.p.
Normal crew (officers and men)	28-30
Armament	14 Lewis guns
Armament	1 1-pdr. automatic
Armament	4 520-lb bombs
Armament	6 230-lb. bombs

The disposal lift *i. e.,* the useful lifting power available for petrol and oil, crew, stores, armaments, ballast, etc., as originally designed, was in excess of 50 tons as against 30 tons in the case of "R33" and "R34," but some reduction of this figure will follow from various additions which have been made, such as bow mooring gear to permit of the airship being moored to a mast.

"R38" will carry, when fully equipped for service, about 30 tons of petrol, which is sufficient for a flight at full speed (70 m. p h.) of 5,000 miles, or at cruising speed (60 m. p. h.) of 6,500 miles, which is equal to the distance from the British Isles to Japan.

In general principles the hull structure follows the standard type as employed in Zeppelins, and previous "R" types. There are, however, numerous alterations in detail resulting in a considerable saving of structural weight. The framework is of Duralumin, and consists of the usual longitudinal lattice girders connected by transverse circumferential girders. There are 14 main gas compartments, containing the gas bags which are of fabric and goldbeaters skin. In cross section the hull is not absolutely circular, but slightly elongated near the bottom. From the third to the eighth gas compartments the sides are parallel. The corridor, or keel, in "R38" is much wider than in previous ships, providing greatly improved accommodation for crew, petrol tanks, water ballast and bombs. The corridor provides communication from end to end of the hull, to the various cars and control stations and to the entrance at the extreme bow from the the mooring mast. On the top of the hull, near the bow, is a gun platform, which will carry a 1-pdr. automatic. This platform is shown in one of the accompanying illustrations. There is also a gun trapdoor on the bottom of the hull at the rear of the aft wing cars.

Altogether there are seven cars, the arrangement of which is as follows: Right forward, at the third gas compartment, is the main control cabin and W. T. room. This car, which has no power plant, is not suspended from the hull, but is rigidly attached thereto, and is comparatively small. At a point between the fourth and fifth compartments are two wing cars, port and starboard, suspended from the hull (by cables) fairly close together, practically level with the keel. Amidships (compartments 6 and 7) are two more wing cars, and these are suspended much higher up and farther apart. Aft of these, at compartments 8-9, are another pair of wing cars, which, as far as we could see, are located similarly to the forward wing cars. Each of these wing cars is of clean streamline shape, with aluminium covering, and contains a 350 h.p. Sunbeam "Cossack" engine, driving a large two-bladed propeller. The forward and aft wing cars are of similar design, and the mid-wing cars appear to be slightly smaller. All have enclosed nose radiators, the front of the car having adjustable shutters. Communication from the wing cars to the hull is by means of a ladder, which folds up to a streamline strut when not in use, and a trapdoor in the side of the hull.

We noticed a slight difference in the arrangement of the tail, in that the balanced portions of the rudders and elevators are formed by projecting surfaces at the extremities. In previous types, it will be remembered, the balanced portion extended from end to end.

It is intended that after trials have been carried out—and it is expected that these may may take place any moment now—and the airship has been handed over to the American Government, the American crew which is now completing airship-training in this country will, after a few further flights to accustom themselves to the behavior of the airship, fly across the Atlantic to a base in America, where a shed has been built to accommodate the ship and where, it is understood, a mooring mast is also to be erected.

In view of the interest which is being taken at the moment in the use of airships for commercial purposes, it is worthy of note that an airship of the "R38" class, adapted for transport, could carry 40 passengers and 2 tons of freight in a non-stop flight to Egypt in about 48 hours.

As a result of the experience gained in the design and construction of "R38" a new design has been produced for an improved type of airship with a gas capacity of about 4,000,000 cu. ft., which would be capable of carrying 50 passengers and 13½ tons of freight on a non-stop flight to Egypt in about 40 hours.

The ZR.2 power wing cars, each containing a 350 H.P. Sunbeam engine. (Courtesy "Flight")

Aero Club of Columbus

The third annual banquet and dance of the Aero Club of Columbus, Ohio, was held at the Hotel Deshler, May 5, 1921. The acquiring of a site for a landing field in Columbus was fittingly celebrated as the first step in the development of aerial activities in this city. Fifty couples, members of the club and their guests, attended. Arrangements for the entertainment were made by William F. Centner, the club's secretary. Two of the guests came in an aeroplane. They were W. H. Webb and George V. McPike, lieutenants at the Wilbur Wright Field at Dayton. Messages were received from Capt. Eddie Rickenbacker and Maj.-Gen. C. T. Menoher.

NAVAL and MILITARY AERONAUTICS

Railroad Reconnaissance by Aeroplane

Locating a railroad by aeroplane is the latest venture of the Third Aero Squadron, Camp Stotsenberg, Philippine Islands, and one long flight has enabled a railroad engineer to determine which one of the three general routes will be utilized for the new road. The saving of many months and thousands of dollars has resulted. Instead of three parties of locating engineers being sent out to make the preliminary survey only one will now be necessary.

The Manila Railroad Company has planned the extension of its line from Cabanatuan through parts of the provinces of Nueva Ecija and Nueva Vizcaya to Bayombong. Parts of the two provinces are very thinly settled and no comprehensive maps or surveys were available. The military authorities are vitally interested in the extension of the Manila Railroad Company line, and accordingly permission was obtained from the Commanding General, Philippine Department, to use a government aeroplane on the preliminary reconnaissance trips.

The first trip was made by Mr. E. S. Von Piontowski, Chief Engineer, in a D.H.4 piloted by Lieut. W. C. Maxwell, 3rd Aero Squadron, Lieut. Maxwell, with the railroad official in the gunner's cockpit passed over Mt. Arayet and then followed the Pampanga River until he picked up the railroad line at Gupan. He followed the river from Cabanatuan on to Pantabangan and over Mt. Pangloriahan, thence to Bayambong. The railroad engineer on the return was enthusiastic over the trip, declaring that the single flight has saved him months of tedious work in running lines through difficult territory. Before his surveying party is sent he plans at least one additional reconnaissance trip.

In this connection the account of the survey by Chief Engineer E. S. Piontowski will be of interest as it bears testimony to the inestimable value and the immense saving of time and money of the aerial reconnaissance in engineering projects. Mr. Piontowski writes:

"The flight was in the nature of a trial trip as I had never been up in the air before and had no idea whether any information of real value could be obtained or not. The trip was a revelation to me and I cannot understand why aeroplanes were never used before in reconnaissance surveys, for as much can be accomplished in one day with a plane as would take months of time and thousands of dollars to do by instrument surveys. The flight was taken at the beginning of the rainy season and shortly after our arrival at the pass the clouds came down and covered the summit of the mountains rendering it impossible to obtain any idea of the other side of the range and the outlets thereto. However, I obtained enough information on this side to demonstrate how much could be done by flights in the dry season; as it was, I can now eliminate two lines on this side that the engineers on survey would necessarily have had to try, and which would have taken many months and great expense to make.

"At present the Manila Railroad has constructed the Cabanatuan branch as far as Cabanatuan and contemplates prolonging this line north through the mountains into the Cagayan valley, and eventually to Aparri on the extreme north end of the Island of Luzon.

"There is no question but that in mountainous and heavily timbered country on which no accurate maps exist, the saving that could be effected by several flights over porposed lines would be enormous, and I anticipate in a short time all railroad surveys through unknown country will be preceded by aeroplane investigation."

Report of Changes of Station Officers for Week Ending May 24

May 19, 1921—Captain Donald R. McComas, relieved from further duty with the Air Service at March Field and returned to duty with the Cavalry at Ft. Brown, Texas.

May 20, 1921—The following Air Service Officers relieved from flying instructions at Carlstrom Field, Arcadia, Florida, and directed to report to the Commanding Officer, for duty: Captain Donald McRae, 1st Lt. Hjalmar F. Carlson, 1st Lt. Charles R. Forrest.

May 23, 1921—Lieutenant Eugene R. Cowles, detailed to Air Service and directed to proceed from Camp Devens, Massachusetts, to Carlstrom Field, Arcadia, Florida, for duty and pilot training effective July 1, 1921.

May 24, 1921—First Lieutenant Richard Derby detailed to Air Service and directed to proceed from Fort Baker, California, to Carlstrom Field, for duty and pilot training, effective July 1, 1921.

May 25, 1921—Major Earl L. Canady, Air Service, relieved from further duty at Langley Field, Hampton, Virginia, and ordered to Washington, D. C., reporting to the Commanding Officer, Walter Reed Hospital, for observation and treatment.

May 26, 1921—Major Floyd C. Hecox, detailed to Air Service and directed to proceed from Camp Sherman, Ohio, to Carlstrom Field for duty and pilot training, effective July 1, 1921.

May 26, 1921—First Lieutenant Howard W. Trefry, relieved from further duty with Air Service at Carlstrom Field, Arcadia, Florida, and returned to duty with the 38th Infantry at Camp Pike, Arkansas, effective July 1, 1921.

May 27, 1921—Major James A. Mars, Air Service, is relieved from further duty at the General Staff College, Washington, D. C., and ordered to Ft. Leavenworth, Kansas, for course of instruction at General Service Schools.

May 28, 1921—Captain William D. Wheeler, Air Service, relieved from further duty at Carlstrom Field, Arcadia, Florida, and ordered to Washington, D. C., for duty in the office, Chief of Air Service.

May 28, 1921—First Lieutenant Harry S. Fuller, detailed to the Air Service and directed to proceed from Camp Boyd, Texas, to Carlstrom Field, Arcadia, Florida, for duty and pilot training, effective July 1, 1921.

May 31, 1921—Captain Edward J. Ralph, Air Service, is relieved from further duty in the Office of the Chief of Air Service and directed to report to the Assistant Secretary of War for duty.

Changes of Station for Week Ending June 8

June 1, 1921—Major Adlai H. Gilkeson relieved from duty at Carlstrom Field, Arcadia, Florida, and ordered to Manila, Philippine Islands, to sail on August 5th transport.

June 2, 1921—Lieutenant Franklin O. Carroll ordered from Massachusetts Institute of Technology, Cambridge, Massachusettes, to McCook Field, Dayton, Ohio, for duty.

June 2, 1921—Lieutenant Harry J. Martin ordered from Carlstrom Field, Arcadia, Florida, to Langley Field, Hampton, Viriginia, for bombing training.

June 3, 1921—Major Archie W. Barry, A. S., relieved from command of Barron Field, Everman, Texas, and ordered to Ross Field, Arcadia, California, for ballon training.

June 4, 1921—Lieutenant Colonel Paul W. Beck, relieved from duty as student officer, Air Service Observation School, Post Field and ordered to assume command at that school.

June 6, 1921—Major Walter W. Vautsmeier ordered from March Field, Riverside, California, to Ross Field, Arcadia, California, for balloon training.

Aerial Photography in Farm Management

For the purpose of demonstrating the many uses of aerial photography in farm management and agricultural development, First Lts. George W. Goddard and Howard K. Ramey, Air Service, were ordered, on May 18, to proceed by aeroplane from Bolling Field, Anacostia, D. C., to Amherst, Mass., for the purpose of making mosaics of the territory in the vicinity of the Massachusetts Agricultural College.

The itinerary of the flight was: Bolling Field to Mitchel Field, Long Island, thence to Amherst, thence to Boston, thence to Portland, Maine.

The flight from Washington to Portland was made in five hours, and the total time consumed in performing the photographic reconnaissance was nine days from time of departure to return.

Mosaics were made from an altitude of 12,000 ft. for the Agricultural College at Amherst of 175 square miles of territory, the time consumed in shooting the photographs being two hours. Mosaics were also made of Portland and of Boston showing the docks at both points.

This work was done by the U. S. Army Air Service in co-operation with the Agricultural Department and Amherst College, and of the Shipping Board, and in the short time consumed in performing the work and the completeness of detail as shown by the mosaics produced, demonstrate conclusively the value of aerial photography in agricultural development and in engineering enterprises of every kind.

FOREIGN NEWS

The Schneider Cup Race

According to the Italian press, it has been decided that, in order to render the water-tightness test really practical, machines must carry out the speed test without draining off any water that may have got into the floats during the navigability test.

The Concours Militaire

The three-engined Goliath, piloted by Gonin, has put up the following performance in the Concours Militaire (4,500 kilometres in 500 kilometre stages): First stage, April 1, 3 h. 47 m.; second stage, April 2, 5 h.; third stage, April 3, 3 h. 55 m.; fourth stage, April 12, 3 h. 17 m.; fifth stage, April 12, 3 h. 45 m.; sixth stage, April 12, 3 h. 17 m.; seventh stage, April 21, 3 h. 15 m.; eighth stage, April 22, 3 h. 58 m.; ninth stage, April 23, 3 h. 34 m. Distance 4,500 kilometres (2,800 miles) in 34 h. 21 m. flying time, or an average speed of 81.5 m.p.h. In addition the following data were ascertained: Speed at 6,500 ft., 93 m.p.h.; at 10,000 ft., 67.5 m.p.h. Ceiling 15,000 feet. Useful load, 4,850 lbs.

Failure of Second Grand Prix Attempt

The second period of the French *Grand Prix de l'Aero Club de France* has been attended by no better luck than was the first one. Bad weather interfered with the first period of three days, and the same cause, plus a few others, has prevented the completion of the course by the two entrants for the second stake. The course is one of approximately 2,400 kilometres (1,500 miles), and is in the form of a letter Y, with the upper arms at Lille and Metz, respectively, and with the foot at Pau. Two machines had been entered for the second period—a twin-engined Goliath piloted by the famous Farman pilots, Bossoutrot and d'Or, and a single-engined machine piloted by Bernard. The former machine left Le Bourget at six minutes past eight on the evening of May 20, and was reported to have rounded the turning point at Lille at 10:04 p. m. Bossoutrot and his companions were back at Le Bourget, where they landed, at 11:36 p. m. They reported to have encountered fog at Lille, and stated that they had to come down to 100 metres. The starboard engine showed signs of overheating. It was therefore not possible for them to continue the journey and they decided to make a second attempt when the engine had been put right. A second start was therefore made on the evening of May 21. Leaving Le Bourget at 7:55 p. m., the Goliath rounded the turning point at Lille at 10 p. m., and after making the return journey alighted at Le Bourget at 11:40 p. m. After filling up, the machine left again at a quarter past twelve (midnight) and proceeded towards Pau, where a landing was made at 12:40. An intermediate landing had to be made *en route* some 240 kilometres from Pau owing to fog. After filling up a start was made for Paris, but the machine returned to Pau in order to change a propeller. A second start was made at 3:32 p. m., and all went well as far as Tours, when the second propeller gave trouble and necessitated a landing. This meant abandoning the attempt. As regards Bernard, he left Le Bourget for Lille at 4:25 and rounded the turning point correctly. However, the fog was so bad that he had to land at Albert, returning later to Le Bourget, but too late to proceed with the attempt.

German State Committee for Aeronautics

The composition of this committee and the duties allotted to members are as follows:

Director Dieterich (Costing for the Luftverkehrs-Versuchsgesellschaft-Air Transport Experimental Co.).

Dr. Eckener (Airships).

Geh. Reg.-Rat. Prof. Dr. Hergesell (General Information—Meteorological and Intelligence Service).

Director Joly (Aerodromes, Test Laboratories, State Research Laboratory).

Director Kasinger (Aircraft Industry, Aircraft and Aerial Transport Exhibition).

Justizrat Dr. Niemeyer (Aerial Law, State Laws for Aerial Transport).

Director Rasch (Aerial Transport).

Oberstleutnant Siegert.

Kaptltnt v. Santen (Aeroplanes and Air Pilots).

Geh. Reg.-Rat. Prof. Dr. Schutte (Airships and Traffic).

Prof. Dr. Ing. Junkers (Aircraft Construction and Tests).

Major v. Tschudi (Associations, Airmen's Benefits, Aerodromes, Air Sports).

Dr. Sperling (Engine Industry, Aircraft and Aerial Transport Exhibition, Insurance and Liability).

Director Mackenthun of the Deutsche Luftreederei (Practical Aerial Transport).

Director Dr. Ing. Rumpler (Aeroplane Construction).

Director Dr. Ing. Hoff (Technical and Scientific Affairs relative to aviation, Tests and Research).

Director Niemann (Wireless in Connection with Aviation).

Major Neumann (Press and Technical Schools).

Prize for Mooring Mast

The Grissell Prize (a gold medal and £50) of the Royal Institute of British Architects will this year be awarded for the best design for a mooring mast for an airship in connection with an hotel accommodating fifty passengers. All work must be delievered at the office of the Royal Institute addressed to The Secretary, R. I. B. A., No. 9 Conduit Street, Regent Street, W.1, on or before December 10, 1921. The mooring mast to be 160 ft. high, and to accommodate (1) two lifts, each carrying ten pasengers. (2) 12-in. pipe for gas; 6-in. pipe for water; 6-in. hawser pipe; 2-in. petrol main. Pull of airship estimated at 40 tons. The diagram shows the pivoted masthead; 8 ft. below this is a balcony with collapsible taffrail for receiving the gangway of the airship; 8 ft. below this is the balcony where the lifts land, the two balconies to be connected by a stairway.

The mast below pivoted head may be any diameter, but it must be noted that the airship is liable to go down by the stern, so that any projection or stay or guide or buildings on the ground must be kept within a cone bounded by the line AB on the diagram.

Hauling machinery room at base of mast.

Garage for 12 cars.

Hotel for 50 passengers.

Drawings Required—¼-in. scale vertical section of mast, with plans as necessary; 1-in. scale details sufficient to exjlain the construction; $\frac{1}{16}$th scale plans, sections and elevations of the whole group, showing lay-out and general arrangement of the hotel and other buildings, and their relation to the mooring mast.

Any buildings which are not within the cone above mentioned must be at least 750 ft. from the center of the mast base to clear the airship when it is depressed.

Competitors should send their calculations.

Each design or set of drawings is to be distinguished and delivered as directed in Nos. 1 and 5 of the General Conditions, and each competitor is required to send, in a sealed envelope, a statement in writing that he has not been in practice for a longer term than 10 years, and that all the drawings he submits therewith have been entirely made by himself.

L'Indicateur Aerien

Under the above title an excellent little booklet has been prepared by our esteemed French contemporary *L'Air* that gives in a dozen pages all the information dealing with the French commercial air transport companies.

The following details are given dealing with the Bordeaux-Montpelier, the Nimes-Nice, the Paris-London, the Paris-Brussels-Amsterdam, the Bayonne-Bilbao-Santander, the Paris-Strasbourg-Prague-Warsaw, and the Toulouse-Spain-Casablanca services; offices of the company, times of departure, machines used, prices for passengers and goods, insurance arrangements, postal arrangements, times of collection, etc., in fact everything that concerns aerial transportation.

In order to ensure that everything is up to date, *L'Indicateur Aerien* will be published on the first of every month.

The London Aerial Derby

Mr. H. P. Folland, chief of the designing staff of the Nieuport and General Aircraft Company, Ltd., states that the reports in various sections of the Press to the effect that that company is building or designing, or is having built or designed for it a high-speed monoplane or biplane with a 450-h.p. Napier "Lion" or any other engine, is absolutely untrue, nor is there any grain of truth in the suggestion whatever. This report has not been published in *The Aeroplane.*

It is just possible, however, that the directors of the Nieuport Company may decide to enter the "Goshawk" for the race. This machine still holds the British speed record which it obtained even though the engine was not running all out at the time.

The Handasyde Aircraft Company are entering a cantilever monoplane. This, one believes, is an evolution of the "Semi-quaver," now the property of that company. In its new form it will probably be called the "Semi-breve" or the Demi-semi-quaver." Mr. Raynham will probably be the pilot.

A. V. Roe and Co. are entering three or four machines. The first string one gathers is a very fast machine with a Napier "Lion" engine. At least so rumor says, though one does not vouch for the accuracy of that statement, but many facts point to its being true. There will almost certainly be a "Baby" Avro or two in for the handicap. Mr. Bert Hinkler hopes to be back from the Antipodes in time for the race.

As already announced, the Bristol Aeroplane Company is entering a machine with a 400 h.p. Bristol "Jupiter" engine to be flown by Mr. Uwins. A second entry from that firm is possible.

The dark horse of the race is a small biplane to be fitted with a 450 h.p. Napier engine, which will be known as the "Bamel." It has been designed by one of the best known designers of speed machines in the country and is being constructed by a firm whose name is not well known.

M. Sadi Lecointe, the winner of the Gordon Bennett Cup, has definitely entered on a Nieuport with a 300-h.p. Hispano-Suiza engine.

It is also rumored fairly reliably that the French are entering a Spad and a Hanriot monoplane.

The Helicopter in England

The following discussion took place in the British House of Commons recently:

Lieut.-Commander Kenworthy, on May 24, asked the Secretary of State for Air if he is in a position to state the result of recent experiments with the helicopter flying machine; whether experiments are being continued; whether he will consider offering a prize or bonus to inventors for successful flights made under, or improvements to, this system; and whether the Air Ministry is using all possible efforts to develop this system in view of its possibilities for commercial flying?

Capt. Guest: In reply to the first and second parts of the honorable and gallant Member's question, I regret to say that the developments of the helicopter experiments are not yet sufficiently advanced to show definite results, but as soon as they are obtained, full information will be given. Any one who solves this prblem will be sufficiently rewarded by the patents which he will retain and the number of orders which he will receive. The Air Ministry are conducting experiments in this direction, and are utilizing the brains and money which are at their disposal in the way which seems to them to promise the best and speediest result.

Lieut.-Commander Kenworthy: Is the right honorable gentleman aware that the French have offered substantial prizes to any one who solves the problem? Would it not be worth while for the Ministry also to offer prizes in view of the benefit that would be derived?

Capt. Guest: The system of bonuses and prizes for inventions was, as the honorable gentleman knows, in operation during the War, but since then we have had to discontinue it.

Mr. Raper asked whether the Air Ministry is financing experiments with a helicopter at or near Farnborough, which are being carried on by Mr. Brennan; if so, whether the Brennan helicopter has been given a trial; whether it has succeeded in rising from the ground; and what sum has been allocated for these experiments?

Capt. Guest: The answer to the first part of the question is in the affirmative. To the second and third parts, in the negative, and to the fourth, that a sufficient sum has been allocated to enable these promising experiments to be continued.

ELEMENTARY AERONAUTICS *and* MODEL NOTES

Scientific Models Built By Aerial Age Reader

MODELS of many varieties have been designed and constructed by an enthusiastic reader of AERIAL AGE, Mr. Carl H. Fastje, of Dennison, Iowa. Complete descriptions of the construction as well as notes on the flying performances of some of these types have been compiled by Mr. Fastje for the benefit of our model page readers.

Among the latest designs are a tractor monoplane compressed-air motored model of original design; a fifty-four inch span "A" frame hand-launched model; a racing type "R. O. G." model with a thirty-three-inch span and a scale model of the Curtiss 18-T triplane, which has a span of thirty-two inches.

The fifty-four-inch span "A" type model has a seven-inch chord. Ribs are covered on the top side only with bamboo paper. The elevator plane has a span of eighteen inches and a four-inch chord. The leading edge of this plane is given a dihedral angle while the rear edge is left straight.

Originally the fuselage measured sixty inches, but was later reduced to forty-eight inches. Eighteen-inch propellers were used with the longer frame but sixteen-inch propellers were later found to be more desirable.

Sixteen strands of one-sixteenth-inch flat rubber is used for each propeller. About two minutes' time is required for these strands to completely unwind. There is but one cross-brace of split bamboo on the frame, so taking into consideration the size of the model, it is quite light in weight.

Some very satisfactory flights have been made with this model during the spring. Each flight has averaged from twenty-five hundred to three thousand feet. On June 11 a demonstration of this model was made for a former U. S. Army flying instructor. Two flights were made. On the first flight the model reached a total distance of twenty-five hundred feet. For the second flight the elastic was wound up as much as safety permitted. When launched it rose to a height of about fifty feet, when it made a loop and flattened out. It then started climbing in earnest as it flew further away. As near as could be judged, the model reached fully two hundred and fifty feet at its highest point.

On its descent the model described about five large circles. Measured in a straight line the distance between the starting and landing points was three thousand feet. Considering the distance covered during the circling, the actual territory covered must have been close to five thousand feet or nearly a full mile. During this flight the machine remained in the air a little short of three minutes. As this model has proven to be such a consistent performer it is to be reproduced, with some improvements in design, etc., giving promise of record results.

The "R. O. G." type model has a three-foot frame and twelve-inch propellers; wing span thirty-three inches; chord five inches. Wings are double surfaced and of the solid wood rib type. This model flies better than fifteen hundred feet regularly, rising from the ground.

Mr. Fastje's compressed-air driven model, which has a five-foot wing span and a two-cylinder opposed compressed-air engine, will be described in a later issue.

Illinois Model Aero Club Notes

The Illinois Model Aero Club held its first contest of the season on June 5. This was one of the most successful contests this club has held for a long time and it brought out in a very clear manner many valuable post-war developments. The principal advancement was noted in the more extensive use of hollow and channelled spars and balsa wood construction.

The contest was held for machines of the hand-launched duration type and the following list shows the distance made in each of the three flights allowed and summing these flights to an official average:

Contestant.	*First Flight*	*Second Flight*	*Third Flight*	*Average (Seconds)*	*Points Scored*
Jaros	153.4	130.6	146.2	143.4	100
Melbye	111.6	138.2	73.8	107.9	75
DeLancey	83.6	83.2	96.2	87.7	61
Pond	108.0	100.2	14.8	74.3	52
Schweitzer	146.6	wrecked		48.9	34
Coe	82.0	29.6	25.0	45.5	32
Wooley	70.8	59.0	0.3	43.3	30

Some very good flights were made by machines not in the contest. The most spectacular of these flights was one made by Mr. R. Jaros. In his flight, which was flown in a light northwest wind, the model traveled a distance of more than 3,500 feet while the machine remained in the air for a duration of 179 seconds. This model has proven itself to be able to fly consistently in the neighborhood of the 2½ minute mark.

All the contests held by the Illinois Model Aero Club are conducted under the following rules:

Rules for the Establishment of Record

(1) In order that a record be official, at least three members of the contest committee or of the board of governors of the Illinois Model Aero Club other than the owner and flier of the model, must witness and judge the flight.

(2a) A duration flight must be timed by an accurate split second, fly-back stop-watch.

(2b A distance flight must be measured with a one-hundred foot steel tape. If no tape is available at the time of the flight, the starting and alighting places of the model may be carefully and unmistakably marked and measured at another time according to rules one and two.

(3a) Any flight made at a meet or at any time and place previously designated for a meet, if the meet is postponed or called off, may be accepted as a record.

(3b) At such time and place as designated in rule 3a, the model need not be of the type for which the meet was announced, nor need the flight be official in that meet.

(4) If at any time any member wishes to try for a record not designated in rule 3a, he may announce his intentions and whether he is out for a distance or a duration record, at a regular business meeting, and arrange for a time and place convenient to both, when rule one may be fulfilled.

(5) In order that a record may be declared official and recognized by the club, the board of governors must vote it so at a regular business meeting of the club or of the board of governors.

(6) These rules shall supercede all similar and conflicting rules on the same subject.

Mr. Warren H. DeLancey, corresponding secretary of the Illinois Model Aero Club, submits the following list of what is believed to be the present world's records for rubber-driven models. The Illinois Club is desirous of ascertaining whether any of these records have been exceeded by any flights which conform substantially to the above mentioned rules:

Official World's Records

1—Twin Pusher, hand launched; duration, 230.8 sec.—Wm. Schweitzer.

2—Twin Pusher, R. O. G.; duration, 178 sec.—Wallace Lauder.

3—Twin Pusher, hydro; duration, 118 sec.—Bruno Likosiak.

4—Twin Pusher, hand launched; distance, 5337 feet; Thomas Hall.

5—Twin pusher, R. O. G.; distance, 4029 feet—Wm. Schweitzer.

6—Tractor, hand launched; duration, 240 sec.—Don. Lathrup.

7—Tractor, R. O. G.; duration, 227.4 sec.—P. Breckenridge.

8—Tractor, hydro; duration, 116 sec.—Lindsey Hittle.

9—Tractor, hand launched; distance, 2465 feet—Bertram Pond.

10—Tractor, R. O. G.; distance, 2685 feet—P. Breckenridge.

All the above records are held by members of the Illinois Model Aero Club with the exception of No. 2, which is held by the Aero Science Club of New York of which Mr. Wallace Lauder is a member.

Minnesota Aviator Desires to Join Model Club

Lt. D. P. Rolfe, of 930 Telfair street, Augusta, Ga., is intensely interested in the development of models and would like to get in touch with residents of St. Paul or Minneapolis, Minn., which is his home town. Anyone in these cities who is interested along these lines will find Lt. Rolfe, who is an aviator, quite willing to engage in the active organization of a live club in the middle northwest.

The Observer's Lot

(With apologies to W. S. Gilbert.

When observers are quite new to their vocation, their vocation,
And have very seldom flown in a machine, in a machine,
They are absolutely struck on aviation, aviation
And will fly with any pilot, they're so keen, they're so keen.
Some pilots one decidedly should smother, one should smother,
When there's any sort of duty to be done, to be done,
Taking one consideration with another, with another,
An observer's lot is not a happy one.
There's the pilot who is new to his profession, his profession,
And has often smashed a 'plane to little bits, little bits,
It becomes with him a terrible obsession, 'ble obsession,
To take us up and scare us into fits, into fits.
One pilot is the same as any other, any other,
When there isn't any duty to be done, to be done,
Taking one consideration with another, with another,
An observer's lot is not a happy one.

If Only—

If only the air were not airy,
Nor silly, nor sloppy, nor soft,
Or flying so terribly scary,
How nice it would be up aloft!

If nose dives had not been invented,
And no one had thought of the crash,
Our heads would not be so dented,
And flying would not be so rash.

If 'buses did not need controlling
To put all the little faults right,
Such as diving, or pitching, or rolling,
Why, there would be yells of delight.

If only they'd asked *me* about it,
And just let me fly for a year,
I'd show them that they couldn't doubt it,
But hang it, I shouldn't be here.

E. W. SCOTT.

Why the Water Bill Was so High

The Ultimate Missile

A seaplane was his and a seaplane was mine,
We started the scrap at a quarter-past nine;
To settle the issue beyond any doubt,
We came down on the water to fight it out.
I fired my gun till the trays were shot,
Then I fired five rounds from a Webley Scott.
I chucked my trays and I chucked my gun.
I heaved my instruments one by one;
They all of them missed and he started to scoot,
Till I laid him out with a well-aimed boot.

If flies are flies,
Because they fly,
And fleas are fleas,
Because they flee,
And bees are bees,
Because they be,
WHAT IS A GOB?

—*Naval Record.*

A party were visiting the airdrome, and they stopped in front of a refractory engine on which a very oily A.M. was working. The leader of the sightseers said: "Will you tell us what you call this particular engine?" The A.M. grunted, wiped an oily hand across his brow and ventured: "D'ye mean its name, mister, or wot I calls it?"

Unsolicited Advice to a Novice

The Commanding Officer at Kelly Field sends the following poem by Lieutenant Birnn that is very eloquent in its way. It applies particularly to the novice who tries to land an SE5 cross wind:

Stone walls do not an aerodrome make, nor mud a landing field,
And quickly to a cross-wind puff, the SE5 will yield;
Beware the hill near Hangar Three, beware the thick mesquite
If e'er you need seek landing field, this warning I'll repeat—
Stone walls do not an aerodrome make, nor mud a landing place.

So set her on the landing gear and not upon your face,
This SE5 it handles well when way up in the air
Except when you are pullin' stunts there's small need to beware,
So take her off, my hero bold, you'll handle her with ease,
But when you come to set her down, *don't land her 'cross the breeze.*

"How I envy you sea-faring men," breathed the sweet young thing. "How wonderful it must be to gaze on the broad blue-rippled expanse of ocean and smell the clean salt air."

"Yes," answered the coal passer, "it must be."—*American Legion Weekly.*

A boot wants to know how George Washington could have been a married man if he never told a lie.

Scene: Airplane hangar. Irish mechanic busily engaged in shaping a spar with a jack knife.

Asst. Foreman: "Why don't you try (i) plane?"

I. M.: "I haven't got ere a plane."

A. F.: "Well, buy (i) plane."

Foreman: "For the love of Mike, lend the mon a plane."

Sky: "Have you noticed very few aviators wear fancy socks?"

Scraper: "Yes, most of them buy (i) plane."

Young Lady (who has just been operated on for appendicitis): Oh, doctor! Do you think the scar will show?

Doctor: It ought not to.—*The Lyre.*

A lady whose past was uncertain
At night never pulled down her curtain,
And so everyone knew,
In a fortnight or two,
What was and what wasn't uncertain.

AERIAL AGE
WEEKLY

VOL. 13, No. 18 JULY 11, 1921 10 CENTS A COPY

Airscape of the Arkansas River at Pueblo, showing railroad crashes (lower right) from which 50 passengers fled and took refuge on top of the Nuckalls Plant. Note freight cars across river, locomotives of which are lost in water and quicksand of the river. (Photo by Air Photo Co., Denver.)

The Remington-Burnelli Airliner

PUBLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
Subscriptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIII NEW YORK, JULY 11, 1921 NO. 18

Aerial Bradshaws.

FROM different sources two air time-tables have recently been issued. The first of these, issued by the LepAerial Travel Bureau of London gives the times and fares on all the services for which London is the terminus. The second, a more ambitious booklet, entitled the "Aerial Time-table," has been published by our French contemporary, *L'Air*, at a price of 50 centimes, and gives all the information possible about all the French air routes. From next month this aerial Bradshaw will be international in character, and will not deal merely with the French services. From these time-tables one discovers the extent of the organized airways. From London one can fly direct to Paris, Brussels, Rotterdam or Amsterdam. By changing at Paris one can continue to Strasbourg, Prague and Warsaw. By changing at Rotterdam or Amsterdam one can continue the journey to Bremen, Hamburg or Copenhagen, and by changing again at Bremen the journey to Berlin may be completed. At present it is not possible to go by air all the way from London to Morocco. The passenger flies to Paris, and proceeds by train to Toulouse, and then by air to Alicante, Barcelona, Casablanca, Malaga, and Rabat.

Not only can one travel so far afield by air, but these journeys are accomplished in a remarkably short time. For example, should one decide to visit Poland, one would leave London at 2:45 p. m. in order to catch the 4 o'clock machine to Paris, where the aerodrome would be reached by 6:30 p. m. After spending the night in Paris the traveler would leave the French capital at 8:15 the following morning, arriving at Strasbourg at 10:45 and Prague at 3:15. Here, again, a halt would be made for the night. Czecho-Slovakia would be left at 8 o'clock the following morning, and Warsaw reached by 1 o'clock the same day.

The fares from London on this route are:—To Paris, 6 guineas; to Strasbourg, 9 guineas; to Prague, 16 guineas; and Warsaw, £23 2s. Surely these rates cannot be considered excessive when one considers the quickness and the comfort of the journey.

To reach Morocco, the traveler proceeds to Paris by air and continues his journey by sleeping train from Paris at 8:25 the same evening. Next day the journey is continued from Toulouse by air, a stop being made at Barcelona for lunch and at Alicante for the night. Next morning the machine proceeds *via* Malaga and Rabat to Casablanca, the complete journey being accomplished in three days at fares of £21 6s. to Barcelona, £30 to Alicante, £33 3s. to Malaga, £42 9s. to Rabat, and £45 3s. to Casablanca. These fares include the sleeping car express between Paris and Toulouse.

In addition to the routes mentioned there are services from Paris *via* Brussels to Rotterdam and Amsterdam, from Bordeaux to Toulouse, from Bayonne to Santander, from Toulouse to Marseilles, and from Nimes to Nice, whilst services are projected to Madrid, Berlin, Rome, Constantinople and Algiers.

The cheapest trip from London is to Brussels, the fare being 5 guineas single and 9 guineas return. All these services are carried out with up-to-date commercial machines having enclosed cabins for the carriage of passengers and goods. There is no doubt that the air services have come to stay.

The French Services.

IT is doubtful if people in this country realize how rapidly the air services in France are being extended, or how much they have become an established factor in the nation's passenger transport. Hardly any of what may be called the trunk routes is now without its regular air service in being or projected for immediate exploitation. The whole country is rapidly being covered by a network of aerial services almost comparable with the railway map and, what is most important, they appear to be running on a commercial basis. Of course, the government subsidy is accountable in no small measure for this rapid extension of French aerial enterprise, inasmuch as it more or less guarantees the industry against actual heavy loss, and the policy of assisting development as the government is doing appears to be justified up to the hilt.

An example of how far-reaching this development is becoming is to be seen in the long distance service which is successfully operating between Paris and Casablanca, in Morocco. This is actually in operation on four days of the week, and is now to be increased to a daily service for mails and passengers. It is possible by means of this service to go from London to Casablanca in rather less than two days. The traveler proceeds to Paris by air, but, owing to the present want of night-flying facilities, he travels from the French capital to Toulouse by rail. Leaving Toulouse at 10:30 a. m. next morning, he reaches Alicante the same day, rests there the night, and finishes the journey next morning. The rail and boat journey occupies a full six days, with many changes and delays. In the matter of cost, a ticket from London to Casablanca by airway costs £45 3s. The first-class fare by rail and boat, *via* Paris, Madrid and Gibraltar, and thence by steamer to Casablanca, is a little over £20. At first sight, therefore, air travel does not seem to compare very favorably in the matter of cost, but against this has to be set the fact that there is a saving of four clear days in time. In other words, the journey by air is accomplished three times as quickly at twice the cost of rail and steamer. This is, on a comparative basis, quite good, and we should be prepared to back the opinion that the business man who had to make the journey would consider the great saving in time well worth the extra cost, without taking into consideration the feeding arrangements for the extra days. In other words, it is a fair commercial proposition even at the present fares.

The News of the Week

The Late Captain Howard T. Douglas

The Air Service lost one of its most valuable officers when Captain Howard T. Douglas was drowned as the result of an air collision near the wreck of the old San Marcos—formerly the Texas—between the single-seated pursuit plane which he was piloting and the single-seated pursuit plane piloted by Lt. M. J. Plumb.

Captain Douglas was not only an able pilot, but served throughout the war as an aeroplane observer, and, at the time of his death, held both the rating of Aeroplane Pilot and Aeroplane Observer.

Shortly after the declaration of war, Douglas joined the army and volunteered for aviation duty. Upon completion of his training in this country as an aerial observer, he was sent to France, where, after a short course of instruction, he was sent to the front as an observer with a French observation squadron. Because of the excellent type of work he carried on while there, he was shortly recalled with the American Forces, and assigned to the 88th Aero Squadron, just prior to the Chateau Thierry operations. He served throughout the remainder of the war with the American forces—for a time as aerial observer with the 88th, then as operations officer and later as group operations officer. When the troops moved to Coblenz, just after the armistice, Douglas was sent with them, and, for a time prior to his return to the United States, he served in the capacity of Corps Air Officer, the duties of which, although according to Tables of Organization, call for the rank of Colonel, was performed by Douglas with the rank of Captain. Throughout this period he proved himself to be an officer possessed of an excellent sense of duty and of the greatest courage and ability.

Upon his return to the United States, because of his marked ability and of his broad experience overseas, he was assigned to staff duty in the office of the Chief of Air Service in Washington, in which duty he was still acting up to the time of his death.

Because of his eminent fitness for the difficult undertaking, he was made the pathfinder of the Alaskan flying expedition, preceding Captain St. Clair Street and his brother officers for the purpose of blazing the trail in the choosing and the preparation of landing fields. A great deal of credit has been given Captain Douglas in connection with the successful completion of this hazardous undertaking because of his excellent work in preparation for the flight and in arranging for the care of the personnel and of the planes throughout the expedition.

His last assignment in the Operations Division of the Air Service included the working up of a great deal of the details of the bombing project now being carried on at Langley Field, in which he had taken the keenest interest. During the manoeuvers he was assigned for duty as liaison officer between the Army Air Service and the officer in charge of the air forces of the Atlantic Fleet, and his last flight was made for the purpose of keeping himself entirely familiar with the progress of the whole project.

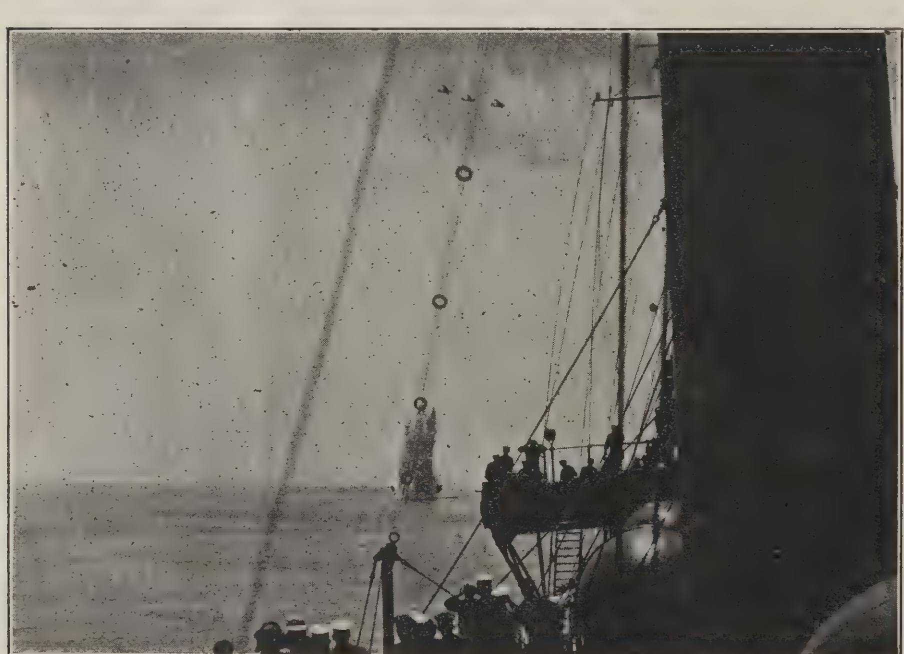
The army as a whole, the Air Service of the army, and the officers individually who were fortunate enough to know Captain Douglas as an officer and as a man feel deeply the unfortunate accident. The excellent characteristics of this officer and the example he set will remain in the memory of those he has left behind.

Red Oak Meet Great Success

With thirty-five pilots entered and 10,000 spectators attending, Iowa's first air meet staged June 23-26 at Red Oak, proved a spectacular success. Fourteen silver loving cups and $750 in cash prizes were offered by the merchants of Red Oak.

Daring acrobatic contests, wing walking, parachute jumping, spot landing, hurdles, altitude tests and cross-country racing featured the four day program. Pilot J. H. Smith, of Grand Island, was the individual star of the meet, carrying home five silver loving cups. Miss Elsie Allan, of Grand Island, won the woman's prize in the wing-walking contest, C. T. Brewer, of Council Bluffs, being awarded the men's prize for acrobatics.

With genuine western hospitality, Red Oak threw open all places of amusement to the visiting pilots, and provided them with hotel rooms and transportation to and from the grounds. Pilot P. Tuttle and D. C. Sanford, of Red Oak, were in charge of the meet.



The full force of the explosion of nine bombs dropped from an altitude of twelve hundred feet on the former German submarine U-117. Naval aviators opened the eyes of Congressmen who witnessed the destruction of the ex-German raider, at maneuvres 60 miles off Hampton Roads, Va., June 21, 1921. (Photo by U. S. Naval Air Service)

Trans-Continental Air Route Guide

There has been issued by the United States Air Mail Service an attractive pamphlet consisting of 70 pages printed by the Government Printing Office giving distances, landmarks, compass course, emergency and regular landing fields, with service and communication facilities at principal points en route. These flying directions, according to an order issued by the Second Assistant Postmaster-General, were prepared with the co-operation of pilots and supervisory officials of the Air Mail Service and with the assistance of the postmasters located within five miles of the line of flight. All employes of the Air Mail Service will be required to familiarize themselves with the information relating to the section of the route with which they are concerned. Copies may be had by applying at the office of the Second Assistant Postmaster General Dision of Air Mails, Washington, D. C.

S. F. Aero Association

The regular meeting of the San Francisco Aero Association took place May 11 at the showrooms of the Walter T. Varney Co. at 832 Post Street and much enthusiasm was shown toward the coming meet. Many interesting topics were brought up and settled. The meeting was attended by Capt. Roy Francis, pilot of international fame.

Hartford Aero Club

Landing fields throughout Connecticut for commercial aeroplanes making flights between New York and Boston are proposed by the Hartford Aero Club. Mayors of Hartford, Bridgeport, New Haven, New London, Danbury, Waterbury, Bristol, Stamford, South Norwalk, Meriden, New Britain, Middletown, Willimantic and Norwich, together with the presidents of the Chambers of Commerce in those cities and the heads of Rotary and Kiwanis Clubs, attended a dinner at Hartford recently. The subject of aviation fields was discussed.

Safety of Flying

There are 1,200 commercial aeroplanes of all types in use in the United States today, and in the last six months these planes have flown approximately 3,250,000 miles. In this flying distance there have been only twenty-seven serious accidents. Fifteen persons were killed and forty-three injured.

These figures are made public by the Manufacturers' Aircraft Association, which has just completed a survey of aviation in America and announces that civilian flying, "although embarrassed by the lack of an American air policy," has established itself as a remarkably safe and

dependable means of transportation. The survey says that most of the accidents occurred among the class of aviators known as "gypsy flyers."

British Battle Planes Carry Scout Machines.

Experiments with a remarkable type of battleplane which carries its own scout machine poised at the tip of one of its wings have been carried out at Farnborough.

Two big bombing planes have been flying over Aldershot with a diminutive aeroplane fixed to the upper wing. So far it is understood the tests have been successful. The parent machines have traveled at their usual pace, although the engine of the scout machine was kept running so that it was ready to dive off at a minute's notice to protect the larger and heavier craft.

The automatic releasing apparatus is constructed on ingenious lines. An expert pilot is carried by the bombing plane and as soon as his services are required he climbs through the top wing and takes his seat in the scout plane. By pressing a trigger, he frees the smaller machine which at once glides along the battleplane wing and dives off.

Sir A. W. Brown Under Knife.

Sir A. Whitten Brown, who flew the Atlantic with Alcock, is recovering from a serious operation upon his stomach after being laid up for several weeks from trouble which developed from two injuries received while in flying service in France and ill treatment in a German prison camp after his capture.

His appendix was removed in an operation of the most delicate nature, but the operation was believed to be successful. It is expected that he will be able to leave the hospital within a month or six weeks, when he plans to take a long rest.

Since the famous transatlantic flight he has been a member of the staff of the Vickers Company, but owing to his health has practically done no flying since he crossed the ocean.

Aeroplanes and the Fight.

Aeroplanes swooping and gliding, circling the great arena and dashing across the middle of the bowl, was one of the sights that greeted Carpentier as he climbed into the ring for his historic bout with Dempsey. The appearance of the French boxer seemed to be the signal for the greatest aerial display of the day—a display, incidentally, that was in violation of the urgent requests of the Jersey City authorities.

The popular temper was clearly shown as one aviator, more reckless than his fellows, cut across the corner of the big bowl and glided a few hundred feet over the heads of the spectators. There were many muttered imprecations, threatening gestures here and there, and murmured protests against the activities of the fliers. A few of the crowd cheered, but most of the spectators seemed to resent the circling and swooping so close to their heads.

Only four of the aeroplanes that hovered around the arena during the day, however, took a course that led them across the amphitheatre. Until Carpentier appeared in the ring to be introduced the aerial stunts had been few and far between. In the early morning one machine flew directly over the centre of the arena, and at 12:10 a moving picture plane flew very low to film the crowds.

New Naval Seaplane.

A new type of naval seaplane is undergoing tests at the naval air station at Rockaway, Long Island. No official announcements as to the characteristics of this machine has so far been issued, but from accounts of eye-witnesses who saw the machine taxying off shore it appears to be a twin-tractor float type monoplane. Judging by the sound of the engines, of which there are two, mounted on the wing, these are Wright types. The *New York World* supplements the information by stating that they are 300 hp. models and that the maximum speed of the machine is 110 knots, or 132 m.p.h.

An interesting feature of the machine is its very thick wing section, which an experienced eye recognizes from afar. According to the *World*, the machine is intended for torpedo or bomb carrying and was built by the Curtiss Aeroplane & Motor Corp.

The Air Photo Company.

The Air Photo Company has been organized in Denver, Colorado, and will specialize in aerial photography exclusively. The company is working in co-operation with the Humphreys Airplane Co., who are Curtiss and Ansaldo agents in Colorado. Frank Fortson is manager of the Air Photo Company.

Air Service Bid.

TORQUE METER—Engineering division, Air Service, McCook Field, Dayton, Ohio,—Bids are wanted until July 8, Circular 221, for 1 propeller torque meter. Address above.

Tests at High Altitudes.

In order to study mental efficiency at great heights Dr. Koschel employs a pnuematic chamber which can be made to agree with a rarefaction up to 7,500 meters in height. The results of the tests carried out on various persons are very interesting, and it is noted that up to 5,500 meters, apart from a certain fatigue and lassitude, no more serious troube wlas observed. At 7,000 meters the mental efficiency of all the subjects was in every respect considerably impaired. Photographs of the apparatus employed in this research are given.

Aviation and Mt. Everest.

Calcutta.—In conjunction with the proposed expedition to climb Mt. Everest, thought to be the highest peak in the world, aeroplanes will be used in reconnaissance work, but the lack of suitable landing fields above the 15,000-foot mark are proving a problem for the officers in charge of the expedition.

It is proposed to assault the 29,000-foot mountain from the North or Thibetan side, as the climb upwards from the Indian plain seems an impossibility.

That a plane might fly over the peak seems well within the realm of possibility, as much greater heights have been attained, but if a landing were made on the Thibetan plateau (elevation 12,000 to 18,000 feet), is seems to be a mechanical impossibility to take off again for a subsequent flight.

This will be the first time that planes will have been used on an extensive scale for the surmounting of a mountain peak, and aviators all over the world are awaiting the results of the expedition.

Aeromarine Airways.

Operating a daily passenger, freight and mail aerial transport service, Aeromarine Airways in six months made more than 160 flights to and from Key West, Fla., and Havana, Cuba, at an average speed of 96 minutes per flight over the 110 miles separating the two terminals.

More than 1,100 passengers were carried in that period. Approximately 26,042 pounds of United States and Cuban mail were carried between the two cities. Aero-Marine Navy flying cruisers accommodating eleven passengers were employed in this service. Aeromarine Airways also operates out of New York City along Atlantic and New England coast and inland waterways.

Scene at the Red Oak, Iowa, Aerial Meet. Insert: Pilot J. H. Smith, of Grand Island, winner of five of the fourteen loving cups presented during the meet

The AIRCRAFT TRADE REVIEW

Long Mileage of Curtiss Planes

Operating two Curtiss Standard planes, John P. Wood and John P. Andrews, of Buffalo, have flown more than 9,000 miles carrying passengers in New York, Pennsylvania, the Virginias, the Carolinas, Georgia and Florida. The planes have had more than 750 hours in the air. The pilots have had as many experiences. Their patronage has included almost everything from carrying company payrolls to transporting prize pigs.

Logan Reports Increasing Business

Rapid deliveries and reasonable prices coupled with a large and varied stock appear to account for the rapid expansion of the business of Floyd J. Logan, the Cleveland jobber in aeroplanes, flying boats, motors and spares.

Mr. Logan reports that his shipments are going to all parts of the United States and expresses great optimism in regard to the increase of aeronautical activities this season.

Kokomo Aviation Meet

Under the auspices of the Curtiss-Indiana Company there will be held in Kokomo, Indiana, an aviation meet on September 20, 21 and 22.

This company, which for the last two years has enjoyed an encellent reputation for doing things, has just opened its new field where every courtesy is extended to transient aviators. The field is well laid out and has a half mile runway in every direction.

At the aviation meet in September gasoline and oil will be supplied to flyers and arrangements are being made for a suitable list of trophies.

Aeronautic Ground Schools

The following colleges, universities, and institutes are offering ground courses in aeronautics:

Brooklyn Polytechnic Institute, Brooklyn, N. Y.; Castle Girls' School, Tarrytown-on-Hudson, N. Y.; College of the City of New York; University of Colorado, Boulder, Colo.; Columbia University, New York City; Culver Military Academy, Culver, Ind.; California Institute of Technology, Pasadena, Cal.; University of Illinois, Urbana, Ill.; Kansas State Agricultural College, Manhattan, Kans.; Massachusetts Institute of Technology, Boston, Mass.; University of Michigan, Ann Arbor, Mich.; New York School of Aeronautics, Box 106, Grand Central P. O., N. Y.; Pennsylvania State College, State College, Pa.; University of Pennsylvania, Philadelphia, Pa.; Purdue University, Lafayette, Ind.; University of Southern Minnesota (College of Engineering), Austin, Minn.; Tufts College, Tufts, Mass.; State College of Washington, Pullman, Wash.; Worcester Polytechnic Institute, Worcester, Mass.

Topographic Mapping

A report of the Committee on Photographic Surveying of the Board of Surveys and Maps of the Federal Government was issued March 10, 1921, as Air Service Information Circular, Vol. II, No. 184, and published by the Chief of Air Service, Washington, D. C. It was first prepared in mimeographed form without illustrations, and has proved so valuable that it is printed in this circular for the information of the members of the Air Service. The members of the committee were assisted in the preparation of this report by the following: Maj. W. C. Sherman, Air Service, U. S. Army; Lieut.-Com. R. M. Griffin, U. S. Navy; Capt. H. E. Hartney, Air Service, U. S. Army; Capt. C. E. Griffin, Air Service, U. S. Army; First Lieut. W. D. Wheeler, Air Service, U. S. Army; G. C. Mattison, Coast and Geodetic Survey; Lieut. W. L. Richardson, U. S. Navy. The following is the personnel of the Committee on Photographic Surveying: Maj. E. H. Marks, Corps of Engineers, U. S. Army, chairman; Brig.-Gen. William Mitchell, Air Service, U. S. Army; Lieut.-Com. Joseph P. Norfleet, U. S. Navy; Maj. J. W. Bagley, Corps of Engineers, U. S. Army; W. E. Parker, Coast and Geodetic Survey.

Trans-Continental Flight

El Paso, Tex.—Lieutenants David R. Davis and Eric Springer, aviators, attempting a non-stop flight from Riverside, Cal., to New York, in the Douglas-Davis Cloudster and who were forced to land in El Paso June 27, will return to Los Angeles by train to prepare for a new flight, they announced at Fort Bliss, where their damaged plane is in a hangar. They plan to return with new parts for their machine, fly back to Los Angeles and then take off again.

Canadian Border Air Harbors

Customs air harbors where aeroplanes coming from the United States into Canada are required to land have been established at Montreal, Deseronto, Ont., Toronto, and Virden, Man.

Lexington Aviation Company

The Lexington Aviation Co. has been formed in Lexington, Ky. The new firm will mainatin a school for pilots and intends to engage in all forms of commercial aviation, such as passenger and merchandise carrying, aerial photography, etc. The officers of the company are: Harry S. Brewer, president; Steve B. Featherston, vice-president; Samuel B. Walton, treasurer; Col. Jim Maret, secretary and advertising manager; Jesse O. Creech, general manager and chief pilot.

New Field at Greeley, Colo.

The Greeley city council has agreed to level off nine blocks of unimproved land at the south end of the city for a landing field. The Greeley Chamber of Commerce voted to furnish money for leasing the tract for one year, with an option to renew the lease.

The Midwest Airplane Co. will build a hangar on the property and has agreed to maintain planes there through the summer season for regular service to Cheyenne, Denver, Colorado Springs and Estes Park.

Seal Location by Aeroplane

As was reported in AERIAL AGE some months ago, an attempt was to be made to locate seal herds by aeroplane on behalf of Canadian interests. We have just received a communication from the Aero Club of America transmitted to them by Capt. J. A. Hamilton of St. John's, Newfoundland, which describes the work done:

The aeroplane base was established at Botwood on the northeast coast and the first satisfactory flight was carried out on March 28th. By this time the ice had broken and the ships began locating the seals which had been driven to one hundred and fifty miles east of Botwood.

Weather conditions during the winter have been unusually severe. There were a number of snow blizzards and a great deal of snow on the ice which was used as an aerodrome. Climatic conditions caused several delays, but the troubles were eventually overcome and considerable valuable experience and data gained.

The longest patrol was made on March 31st to a position of 50° 30′ N, 52° 46′ W, or a total distance out and back of over three hundred miles. This patrol, which was cut short owing to the positions of the sealing steamers not being definitely known, was not sufficient to take the machine to the location of the seals. The range of vision was extremely large and the observer was of the opinion that there will be no difficulty in detecting seals if they are present. In addition to the pilot (Major Cotton) and the observer (Capt. Kean) a second pilot (Capt. Plaistowe) and wireless operator (Mr. Heath) were carried.

During another trip from Botwood to Fogo and return extremely severe conditions were encountered, including an 80-mile-an-hour gale. The aeroplane made the outward journey of 65 miles in 29 minutes but took an hour and three-quarters to return.

Several shorter trips (totalling in all about 55 flights) were made along the coast and inland before the ice-landing conditions prevented further flying on the 18th of April.

The lateness of starting operations prevented the actual securing of the object this year, but the progress made and information gained in the short time at their disposal seems to indicate great possibilities for success in the future should any further attempt be made.

During the operations landing skis were successfully designed, fitted and used.

The machines were the Westland Napier Six-seater Limousine and Siddeley Puma De H. 9.

A New Supermarine

A new amphibian, designed and built as a Fleet Spotter, to the order of the Air Ministry, has just completed acceptance tests at the Supermarine Works.

This machine, which has gained much from the experiences of the constructing firm during the Air Ministry Competition last year, is fitted with a new and improved type of landing gear, which has given extremely satisfactory results on test.

300 H. P. FIAT MODEL A-12 ENGINE

Analysis of Engine

Design: The 300 h.p. Fiat engine is of rugged design resembling rather closely the Mercedes 260 h.p. engine. Light weight has been sacrificed for reliability. Most of the parts are unnecesarily heavy when judged by American standards.

Adapttbility to Production: Practically al parts of this engine involve simple machine work. The engine could be fairly well adapted to American quantity production methods with a few changes.

Performance: The performance of the engine on the dynamometer was satisfactory in regard to power but the fuel consumption was high and the oil consumption was excessive. The brake means effective pressure is rather low.

Adaptability to Aeroplane: This engine provides for straightforward mounting requiring only two engine bed timbers. The head area is low and the engine can be cowled and streamlined with ease.

Accessibility: The accessibility is fairly good. The magnetos, carburetors and pumps can be easily reached for adjustment through openings in the side and bottom of the fuselage.

Description of Engine

Type: The 300 h.p. Fiat Model A-12 Bis aviation engine has six vertical, water-cooled cylinders. It operates with gasoline as a fuel on the four-stroke cycle.

Manufacturer: The engine is manufactured by the Fiat Company of Turin, Italy.

Crankcase: The crankcase is of aluminum alloy in two pieces parted in a horizontal plane at the crankshaft. The upper half has four triple-ribbed brackets on each side, by means of which the engine is attached to the bearers of the fuselage.

Crankshaft: The Crankshaft is of chrome nickel steel and runs in seven white metal bronze backed bearings held between the two halves of the crankcase.

Propeller Hub: The propeller hub is made in two pieces, the shank being integral with the rear flange. On the interior, the shank is tapered and keyed to fit on the crankshaft taper.

Connecting Rods: The chrome nickel steel connecting rods are of H section with drilled webs.

Pistons: The pistons are of a special aluminum alloy and are provided with four cast iron rings above the pin and one at the bottom of the skirt.

Cylinders: The cylinders are built-up steel forgings with welded water jackets of sheet steel.

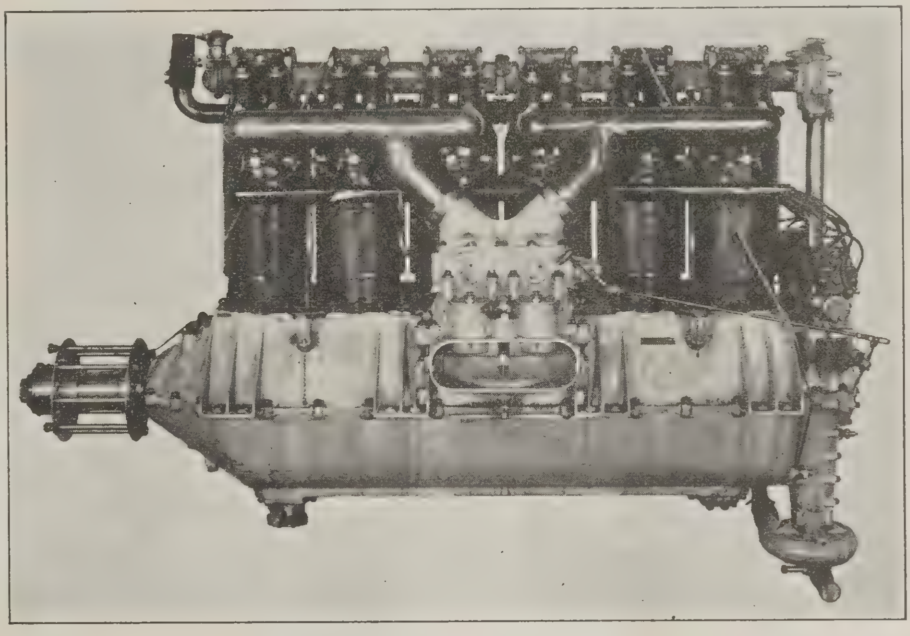
Camshaft and Other Drives: The upper and the lower vertical driveshafts are driven by a bevel gear on the rear end of the crankshaft. The lower vertical driveshaft drives the water pump and the oil pumps. The upper vertical driveshaft drives the magnetos and the camshaft.

Valve Gear and Valves: A single overhead camshaft is inclosed in a bronze housing which is bolted to bosses on the cylinder heads. There are four steel valves per cylinder, two inlet and two exhaust, which work in phosphor bronze guides inclined at an angle of 15° to the cylinder axis.

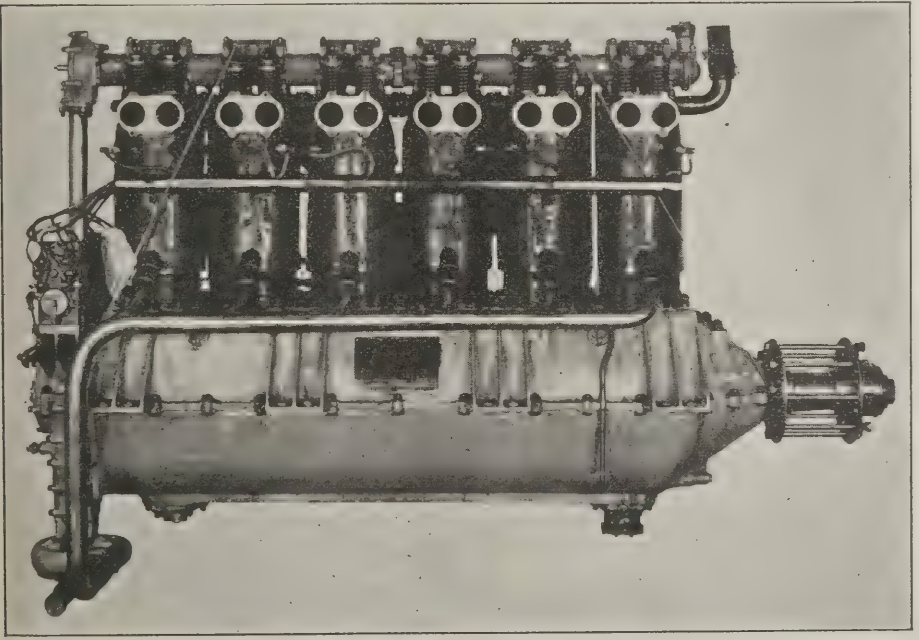
Lubrication System: A duplex gear pump assembly consisting of a pressure pump and a scavenging pump is bolted at the front of the crankcase. An additional scavenging pump is located at the rear end of the crankcase, the two pump assemblies being driven by one shaft.

Cooling System: A centrifugal type of water pump is used to maintain the water circulation.

Carburetor: A water-jacketed carburetor, with four main jets and four venturis, feeds two intake headers. This carburetor is of unusually large size and is similar in its principles of operation to the Mercedes carburetor. A complete description



Intake side 300 H.P. Fiat Engine



Exhaust side 300 H.P. Fiat Engine

may be found in the reference already mentioned. Fiat Model A-12 Bis.

Ignition: Two Dixie magnetos are mounted on a cross bracket cast at the rear of the upper crankcase half. The ignition advance is inter-connected with the carburetor controlling lever so that the spark is advanced as the throttle is opened.

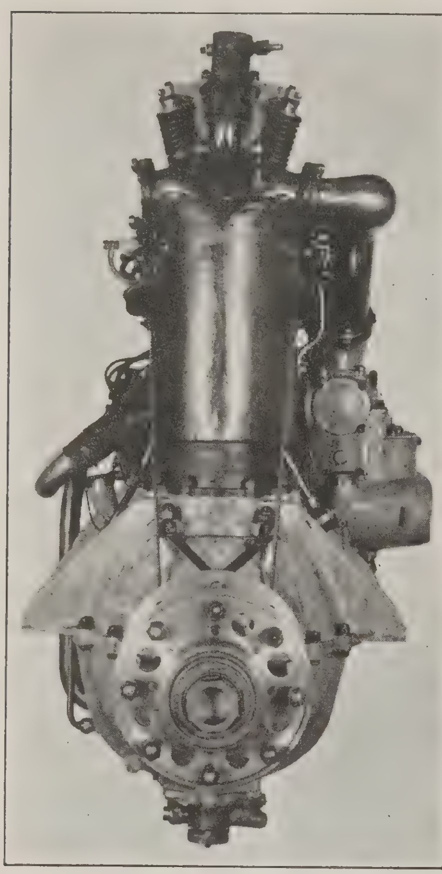
Auxiliaries: A tachometer drive is provided from the rear of the camshaft.

Aeroplane Mounting: This engine can be used either as a tractor or a pusher. The engine is fastened to the bed timbers in the fuselage by 16 bolts, 8 on each side.

Controls: The throttle control and spark control require but one connection to the pilot's seat.

Cooling System: The cooling system is connected to the radiator to form a closed circuit. There are three connections to be made; two inlets to the water pump at the rear end of the lower half of the crankcase, ane one outlet at the top of the front cylinder.

Lubricating System: Three connections must be made to complete the lubrication system. These consist of; an inlet from the tank to the pressure pump beneath the front of the crankcase, an out-



Front end 300 H.P. Fiat Engine

let to the tank at the left of the lower drive shaft, and an oil pressure gauge connection at the right of the lower drive shaft.

Fuel System: The carburetor has to be connected with the fuel supply line.

Ignition System: The ignition system requires three connections, one from each of the magnetos to the switch, and a ground wire from the switch to the engine. This furnishes a means for cutting out either or both of the magnetos.

General Dimensions

Number of cylinders	6
Arrangement	Vertical
Bore	160 mm. 6.30 in.
Stroke	180 mm. 7.09 in.
Piston Displacement of one cylinder	220.8 cu. in.
Total piston displacement	1324.9 cu. in.
Compression volume	60.2 cu. in.
Compression ratio	4.67:1
Stroke-bore ratio	1.125:1
Cooling	Water
Firing order	1-5-3-6-2-4
Method of numbering cylinders	No. 1 is at the propeller end

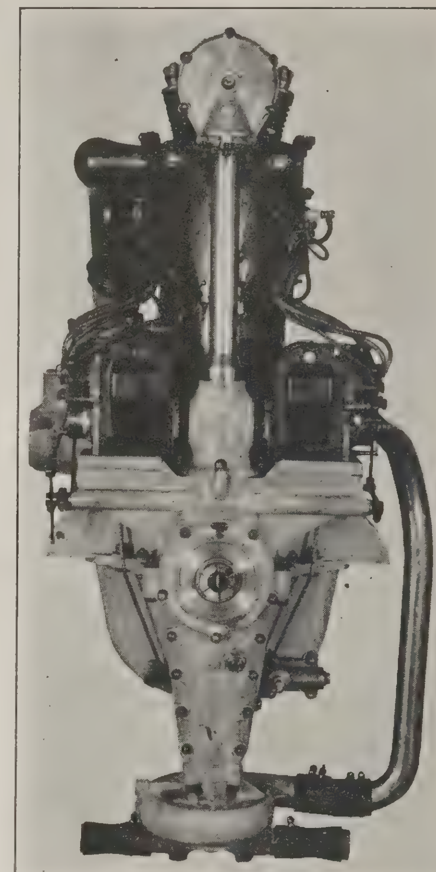
Valve timings:

	Actual average	Designed	
Inlet:			
Opens	7°	10°	before top center
Closes	63°	50°	after bottom center
Exhaust:			
Opens	40°	45°	before bottom center
Closes	21°	15°	after top center

Tappet Clearance:

	Actual average	Designed
Inlet	0.016 in.	0.010 in.
Exhaust	0.024 in.	0.012 in.

Weight of engine without aux. . . . 924 lb.
Weight of water in engine . . . . . . 41 lb.



Rear End 300 H.P. Fiat Engine

The above data is part of a standard report prepared by the Power Plant Section at McCook Field.

The Remington-Burnelli Airliner

(*Concluded from page 420*)

Elevators	104 Sq. Ft.
Vertical Fins	25 Sq. Ft.
Rudders	40 Sq. Ft.

Fuselage

	Weight
Nose Plate	96 lbs.
Panel No. 1	98 lbs.
Panel No. 2	180 lbs.
Panel No. 3	140 lbs.
Panel No. 4	105 lbs.
Panel No. 5	85 lbs.
Panel No. 6	60 lbs.
Panel No. 7	55 lbs.
Stern Beam	37 lbs.
Top Longerons	108 lbs.
Bottom Longerons	105 lbs.
Engine Beams	60 lbs.
Pilot's Floor and Suspen	22 lbs.
Engine Sect. Floor	28 lbs.
Cabin Sect. Floor	152 lbs.
Alcove Floor	70 lbs.
Main Fuselage Fittings	89 lbs.
Cable With Serving, Etc	78 lbs.
Turnbuckles and Shackles	79 lbs.
Bolts	71 lbs.
Tail Skid Assembly	42 lbs.
Cabin Chairs, Bomb Racks, Machine Guns	152 lbs.
Wireless Equipment	50 lbs.
Miscellaneous Parts	90 lbs.
Controls, Complete	187 lbs.
Duraluminum Covering, Windows	400 lbs.
Total	2,439 lbs.

Landing Gear

Wheels, 44" x 8"	304 lbs.
Struts	80 lbs.
Axles	105 lbs.
Rubbers, Etc.	24 lbs.
Total	513 lbs.

Power Plant

Two Liberty Motors	1,800 lbs
Radiators and Fastenings	79 lbs.
Water	226 lbs.
Two Propellers	186 lbs.
Gas Pumps and Lines	16 lbs.
Four Main and One Gravity Tank	250 lbs.
Two Oil Tanks	28 lbs.
Starters (two)	100 lbs.
Instruments	42 lbs.
Contingency	146 lbs.
Total	2,873 lbs.

Empennage

Elevators	82 lbs.
Horizontal Stabilizers	90 lbs.
Vertical Stabilizers	22 lbs.
Rudders	52 lbs.
Tubing and Misc. Parts	47 lbs.
Total	293 lbs.

Wings

Ribs	415 lbs.
Spars	630 lbs.
Stringers and Trailing Edge	70 lbs.
Veneer Entering Edge	110 lbs.
Drag Trussing and Fittings	195 lbs.
Wing Struts	185 lbs.
Wing Truss	94 lbs.
Covering	70 lbs.
Ailerons	250 lbs.

Total Weights

Weight of Machine, Empty	8121 lbs.
Weight of Machine, Loaded	14,621 lbs.
Regulation 25 Pass. Load, or Bombs	3,500 lbs.
Gasoline, Oil, Etc.	3,000 lbs.

AEROPLANE BALANCE

By L. HUGUET

(Technical Note from the National Advisory Committee for Aeronautics)

(Concluded from June 27 issue)

Influence of Wing Profile and of Passive Resistance

THE system of curves on which this whole discussion is based correspond to a given glider. If the general configuration of the glider be modified, the sweep of the curves will be appreciably altered.

We have already shown that the position of the axis of thrust in the glider has a fundamental influence on the general sweep of the α curves.

It is also quite natural to assume that the α curves will change their sweep if the profiles of the wings and tail planes change or if the shape or relative position of the constituent elements of the glider varies (fuselage, landing gear, floats, rigging, etc.). The aerofoils and these elements are, in fact, subject to actions of the air (individual or interferential actions) the sum of which defines the magnitude and direction of the total resultant, and, therefore, the position of the center of thrust the displacement of which we have been studying.

The approximate law of balance which fixes the center of gravity between the forward ⅓ and ¼ of the wing is thus not sufficiently precise to be utilized in all cases without being checked. And when an inventor adopts new arrangements affecting the shape or position of the wings and fuselages, he must, as when he places the axis of thrust in extreme positions, have recourse to wind tunnel tests in order to determine the particular balance curves of his machine and the best relative position of the center of gravity with respect to the wings.

Influence of the Steering Mechanism

Each constituent element of the glider has a greater or less share in determining the law of displacement of the center of thrust in the ensemble. In the present state of our aerodynamical knowledge, however, it seems very difficult to distinguish clearly the part taken by each.

We will endeavor to indicate the sense of the individual action of certain parts (more especially of the steering mechanism) on the displacement of the total center of thrust of the machine, and to find out what important factors of equilibrium may vary with the dimensions, shapes, and relative positions of such steering mechanism.

The torque resulting from the actions of the air on the steering mechanism may be reckoned, as a rough approximation, as being proportional to the surface of the tail s for a cellule of given area S.

It may also be considered as practically proportional to the length of the relative lever arm, that is, for a given depth of wing l, and a distance L from the center of thrust of the tail to the center of total thrust, proportional to L/l.

We may thus write this torque in the form:

$$A \frac{s}{S} \times \frac{L}{l}$$

The coefficient A depends on the profile of the tail planes, that is, on the value of K_y, on the mean velocity V′ of the airstream in which the tail plane finds itself when the speed of the cellule is V, and, lastly, on the relative direction of the air filaments about the tail (a direction which differs from that of the initial airstream on account of the deviation of the air filaments produced by the planes of the cellule).

Briefly, we may represent the relative action of the elevator by an expression of the form:

$$A_1 K_y \frac{V'^2}{v^2} \times \frac{s}{S} \times \frac{L}{l}$$

K_y varies with α according to the tail profile adopted and with the angle of attack of the tail.

V′ always less than V, varies with the drag of the molecules of air along the fuselage preceding the tail.

Experiments made in the laboratory seem to indicate that the airstream along the fuselage may slow down by about 20%.

This loss of velocity is certainly due to the forms of the fuselage and must increase with its length.

It must also depend on the angle of attack, since the relative displacements of the bodies masking the tail planes correspond to variation in the angle of attack.

On actual machines s/S and L/l vary rather slightly. The product S/s × L/l has a value of the order of those given below:

Aeroplanes	s/S	L/l	$\frac{s}{S} \times \frac{L}{l}$
Breguet 14 A2	0.12	3.01	0.362
Salmson 2 A2	0.106	3.33	0.354
Farman 50 Bn2	0.0905	2.94	0.266
Caudron 23 BN2	0.106	3.12	0.33
Spad 13 C 1	0.134	2.73	0.366
S. E. A. 4 C 2	0.1016	3.22	0.327
Fokker D 7 C 1	0.1276	3.10	0.396
Henri-Paul Bn2 (the glider studied)	0.100	3.26	0.326

The variations of the product $\frac{s}{S} \times \frac{L}{l}$ must have a combined action on the α curves, displacing them in relation to the wing, moving them backwards when the product diminishes, and forward when it increases. These variations must also act on the relative spacing of the curves and on their slope with respect to the axis of the thrust.

By varying this product it should therefore be possible to enlarge the region of

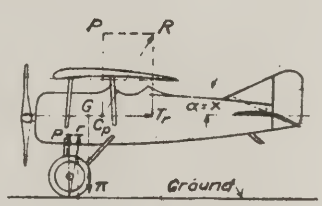


Fig. 13

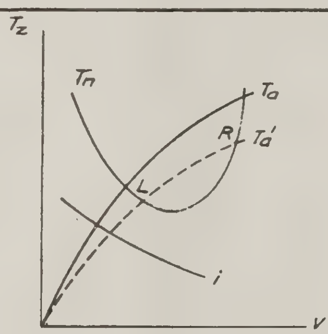


Fig. 15

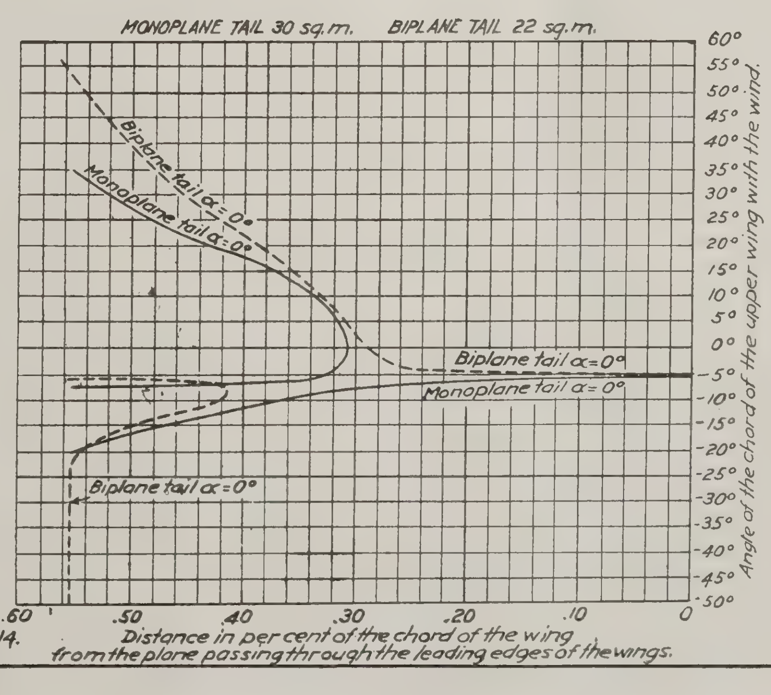


Fig. 14. Distance in per cent of the chord of the wing from the plane passing through the leading edges of the wings.

good stability and thus make it easier to balance the machine.

This appears by a comparison of Figs. 7 and 12, which correspond to gliders having monoplane tails of different areas.

It should, however, be noted that this product s/S x L/l cannot be indefinitely increased, for this involves an increase in the weight and dimensions of the fuselage, and this is often incompatible with the laws of good construction and with the conditions of form essential to the tail and fuselage. We further note that the relative variations of L can only be small, and experience shows that the gain obtained by the increase of L/l tends rapidly towards zero.

This may be partly explained by the decrease of V′ which inevitably results from the increase of L, and which produces a result the contrary of that sought.

The variations of the ratio V′/V have the same influences as those of s/S and L/l.

Therefore, in each particular case it is of advantage to adopt the arrangement of tail planes for which this ratio is maximum and for which the elevator action is the most efficient.

The best position of tail planes is, of course, found outside the wake of the fuselage in regions where V′ is practically equal to V; this is partly realized for the upper part of biplane tails and for the tails of machines having connecting beams.

In point of fact, the position giving the best ratio V′/V is not the same for all cases of flight. This ratio varies with the angle of attack at which the machine is flying.

In flight at small angles, the monoplane tail is in the wake of the fuselage and has, therefore, a poor V′/V; while at large angles it has only a small part of the fuselage in front of it and again has a very good V′/V.

On the contrary, the biplane tail has a better V′/V at small angles and a poorer one at large angles.

On the α curves this is marked by a variation in the curves, the α curve of the biplane tail having the least slope at small angles of attack, and the monoplane tail having the least slope at large angles.

This appears clearly on Fig. 14, where the displacement of the curves may be attributed to difference of tail area, but where the variations of curvature are to be imputed to the difference in the kind of tail adopted.

Lastly, the ratio of the flexible to the fixed parts and the tail profile have an influence which combines with that of the wing profile to give the α curves their general sweep.

If the tail is biplane, the influence of the interaction of the planes and that of the supplementary passive resistances diminish its fineness ratio and thus partially reduce the gain which might have been hoped for from the increase of V′/V.

Sensitiveness of the Aeroplane to the Action of the Steering Mechanism

We will define the sensitiveness of the glider to the action of the steering mechanism by the relative magnitude of the displacement of the center of total thrust corresponding to a given variation of the setting for a given angle of attack.

Given the general sweep of the α curves, the aeroplane is more sensitive to the action of the steering mechanism as the α curves are relatively further apart and as their slope is less pronounced.

Summarizing the foregoing remarks, we may conclude that the sensitiveness of the machine depends:

1st. On the position of the center of gravity which defines the region in which these curves are utilized at normal regimes.

2nd. On the position of the axis of thrust in the glider, the form of the α curves varying with this position.

3rd. On the ratios s/S, L/l, V′/V.

4th. On the polars of the wings of the cellule, and *on the tail planes.*

5th. On the ratio of the fixed and flexible parts of the tail plane.

Considering the multiplicity of causes, we can see how difficult it is to analyze the phenomena observed in each particular flight.

In our opinion, it is indispensably necessary to have wind tunnel tests made for each case, giving the curves on which the balance of the machine can be based.

A discussion of this kind is only useful as it serves to give a rational direction to research work and to indicate the modifications in the parts of the glider which are the most likely to lead to the desired results.

For instance: it should be noted that for monoplane tails, considering the influence of V′/V, there will generally be every advantage in making them with a large span and small depth.

This fineness ratio should be carried as far as the possibilities of solid, rigid construction permit.

Equilibrium of Forces

All the preceding conclusions have been obtained by studying the relative position of the forces concerned, without taking into account the order of magnitude of these forces.

Hence, the stability of the glider has only been studied as regards movement about the center of gravity, taking as reference direction that of the relative velocity of the air without considering climbs or loss of altitude which may result from the maintenance of balance; these considerations may, however, be of vital importance in certain conditions of flight, in particular, in flight near the ground.

In order to render this discussion complete, we must consider the other equations of flight, and in particular the equation of lift and the equation of power. Here also we will assume that there is an established regime, namely, that of a horizontal flight uniformly rectilinear.

Comparing at a given altitude (Fig. 15) the power required and the power available for horizontal flight at a given altitude (consequently at a given angle of attack) it is easy to see what are the conditions of equilibrium of these two powers, and, hence, of the stability of the corresponding regime.

If we fix the throttle setting, we dispose, according to the efficiency of the propeller (which itself depends on the speed of displacement V), of a power of thrust represented in function of this speed V by a curve T′a altogether below the curve Ta which represents the maximum power available at full throttle.

The curve T′a intersecting the curve of required power at two points, L and R, only two regimes of flight are possible at the altitude considered. The regime marked by L is that of slow flight; it marks the lowest speed at which, with the throttle adopted, the machine can keep at the altitude considered. The point R marks the high speed regime usually employed.

Slow flight is obtained with a large angle of attack, high speed with small angles.

We have shown that at large angles of attack, the glider considered alone was in stable equilibrium, whatever might be the balance of the machine, provided that the elevator was efficient.

In flight at large angles of attack the equilibrium of forces is, on the contrary, unstable. On Fig. 15 it can be seen that if, at point L there is an accidental reduction of available power, the machine is subjected to drag and its speed decreases. Now, at a lower speed it must have a larger angle of attack in order to keep the same altitude. From this increase in the angle of incidence comes an increase in the power required for the flight, augmenting still further the initial conditions in which the forces are not in equilibrium. This regime is therefore dangerous in flight near the ground.

As a matter of fact, if the pilot does not touch the elevator, the machine, having stability of form, begins to descend, keeping, with respect to its line of flight, the angle of flight corresponding to the setting of the elevator.

Thus, by the action of gravity, the power required is found during the descent.

If, on the contrary, the pilot does not wish to descend on account of the configuration of the ground, and makes the mistake of pulling the stick in the hope of keeping his altitude by increasing the angle of incidence, he adds to the conditions in which the forces are not in equilibrium and comes down still more rapidly.

At high speed regime (angles of attack smaller than the angle of minimum power required), the glider is stable, that is, it keeps a determined position with respect to the relative velocity of the airstream, provided that the center of gravity is not too far back.

The equilibrium of force is then stable also in horizontal flight, and in studying a case similar to that at L, we remark at the point of equilibrium R, that if there is a reduction of available power, the result is such a decrease of speed that, at the altitude considered, the required power is reduced even more than the power available, so that the flight continues with excess power and the variations in power are such that they act against the accidental conditions in which the forces are not in equilibrium.

In any case, the pilot can be sure of keeping his altitude by a maneuver which will counterbalance the accidental variation of the angle of attack.

At the altitude considered, he is safe so long as the power available is greater than the minimum of power required for flight at that altitude.

To sum up: if we consider only machines with coinciding centers:

For small angles of attack: aeroplanes having the center of gravity too far back are unstable from the fact that variations in the position of the center of thrust are caused by disturbances which produce elementary variations of the angle of attack.

Aeroplanes in which the vertical of the center of gravity falls in the forward 1/3 of the wing are stable, and their stability is greater as the center of gravity is further forward. These machines are very sensitive to elevator action at small angles.

The angle of flight being less than the angle of minimum power, the equilibrium of forces is stable in horizontal flight.

For large angles of attack greater than the angle of minimum power required for flight at the given altitude, the regime of horizontal flight is unstable, owing to the instability of the equilibrium of available and required power, whatever be the balance of the machine.

Still, planes balanced to the rear have, generally, at these large angles, a stable glider, that is, which has an automatic tendency to keep the same angle of attack with respect to the relative airstream; while machines balanced forward have the glider non-maneuverable and incapable of finding equilibrium in flight owing to the insufficiency of its steering organs. In point of fact, the latter defect gives relative safety, since it makes low speed impossible.

In discussing the stability of the equilibrium of forces, we have not brought in the position of the axis of thrust with respect to the center of gravity of the machine. A few remarks should be made on this subject.

The variations of power may produce accidental conditions in which the forces are not in equilibrium between the propeller thrust and the resistance of the air to thrust. What may be the effect of such conditions in which the forces are not in equilibrium on the machine?

For a plane having its center of gravity below the axis of thrust, if the thrust increases the machine tends to dive; if thrust decreases, it has a tendency to point upwards. Both these tendencies are usually contrary to the wish of the pilot, who, normally, accelerates the engine for climbing and reduces the throttle for a descent.

Still, these tendencies correspond to the maneuvers which have to be made at high speed regime in order to keep the same altitude in spite of variations of power.

For a machine having its center of gravity above the axis of thrust, if thrust increases the machine has a tendency to point upwards; if thrust diminishes, the tendency is to point downwards. The tendencies of the machine combat the accidental conditions in which the forces are not in equilibrium of the powers and also normally correspond to the reflex maneuvers which the pilot must make for ascending or descending.

Conclusions

We have indicated the multiplicity of elements involved in the equilibrium of an aeroplane, the variation of which usuallly defines the conditions of balance which must be realized.

The choice of the wing profile is generally decided by aerodynamical considerations and corresponds to the performances which the constructor wishes to obtain.

On the other hand, the position of the axis of propeller thrust is determined by structural considerations and according to the use for which the machine is intended; nor, generally speaking, can this position be varied to any appreciable extent. It should, however, be placed as low as possible, having regard to the conditions arising from the type of machine to be built.

We also stated that the length of the fuselage is fixed to within very slight variations, practically without influence.

Therefore, for improving the balance of an aeroplane, we can alter:

1st. The position of the center of gravity.

2nd. The dimensions of the tail.

3rd. The profile of the tail.

4th. The position of the tail planes.

By making wind tunnel tests on the glider with different tails, it is possible to determine what tail arrangement, having regard to the axis of thrust, will give the system of α curves affording the most extensive region of good balance.

In this region should be placed the center of gravity.

Unfortunately, the position of this center of gravity is also affected by considerations of construction and load, and it can only be varied within extremely narrow limits, even on model machines.

In serial machines, tolerances of construction may so greatly modify the position of the center of gravity as to render the balance of one machine very different from that of its neighbor.

Therefore, in order to be able to give good balance to each particular machine, it is absolutely necessary to allow a certain amount of tolerance in construction so that large masses may be displaced by a few centimeters.

For instance, we should be able to displace the fuselage with respect to the cellule (small variations of L are of no importance) or, in multimotors with lateral beds, we should be able to slightly change the position of the engines in the beds.

Since such possible displacements will generally be very small, we see the great advantage of *basing them on wind tunnel tests.*

These tests will enable us to find the general arrangement of glider offering the best guarantees of stability, sensitiveness, and maneuverability.

Position of Eventual Load—The load of the aeroplane may change, as also the weight of fuel it carries.

Therefore the elements of this load and the gasoline tanks must be so placed that any loss of weight in them will not injure the stability of the machine.

In the first place, they should be placed as near as possible to the center of gravity.

In the second place, if the machine is well balanced with a full load, the weights which may vary should preferably be placed to the rear of the center of gravity, so that a lightening of weight will throw the total center of gravity further forward, thus increasing stability.

In placing such weights as tanks, bombs, or mail bags too far to the rear of the center of gravity, we fall however, into another error, for the lightened aeroplane will be balanced too far forward and will only be able to land at a small angle of attack involving too high landing speed.

If the machine is balanced forward when loaded, the variable masses may be in advance of the center of gravity; the lightening of the machine will allow it to land at a larger angle, that is, at a lower speed, without any injury to its stability.

We must again repeat that the really unstable machines are those having the center of gravity too far back, or the axis of thrust placed too high in the glider.

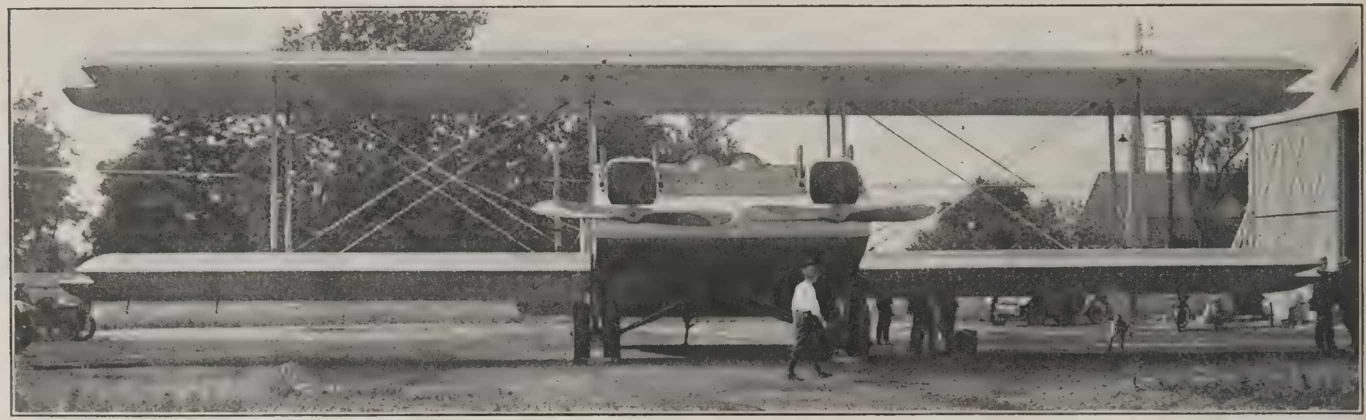
Machines having the axis of thrust too high may be completely unstable at normal regimes of flight; they will fly better inverted than in a normal position.

The wheels should be placed slightly in advance of the center of gravity, but when the machine is in the line of flight the ground angle need not be more than a few degrees. For aeroplanes having the main wheels on the vertical of the center of gravity, an auxiliary set of wheels may be placed in front of them in order to increase safety; these will prevent the machine capsizing when maneuvering on the ground at reduced speed. These extra wheels should not be usually employed in taking off and landing; they will only touch the ground in case of an exaggerated nose dive.

Lastly, we can only once more urge aeroplane manufacturers to interest themselves very especially in wind tunnel tests.

These tests may not always give satisfactory quantitative results, but they will always give the sense of the variation of effects, they will determine causes and will serve as a sure guide to the seeker, who would otherwise wander blindly; his work would certainly suffer if he neglected to guide himself by well thought out tests on reduced models of his machine.

Translated from "La Vie Technique & Industrielle," 1920, by the Paris Office, N. A. C. A.



THE REMINGTON-BURNELLI AIRLINER

THE Remington-Burnelli twin-Liberty engined airliner had its initial flight test at Curtiss Field, Garden City, last week. Test Pilot Bert Acosta was at the wheel and was thoroughly satisfied with the performance of the machine.

The airliner, which will be known as the R. B. 1, was built by the Airliner Engineering Corporation, at Amityville, L. I., as was reported in AERIAL AGE for March 28th, the officers of which company were Messrs. Remington and Cox, and Burnelli, chief engineer. Mr. Cox has since severed his connection with the organization, and expects soon to announce plans concerning the organization of a new company, of which he will be president.

The general specifications of the R. B. 1 are as follows:

General

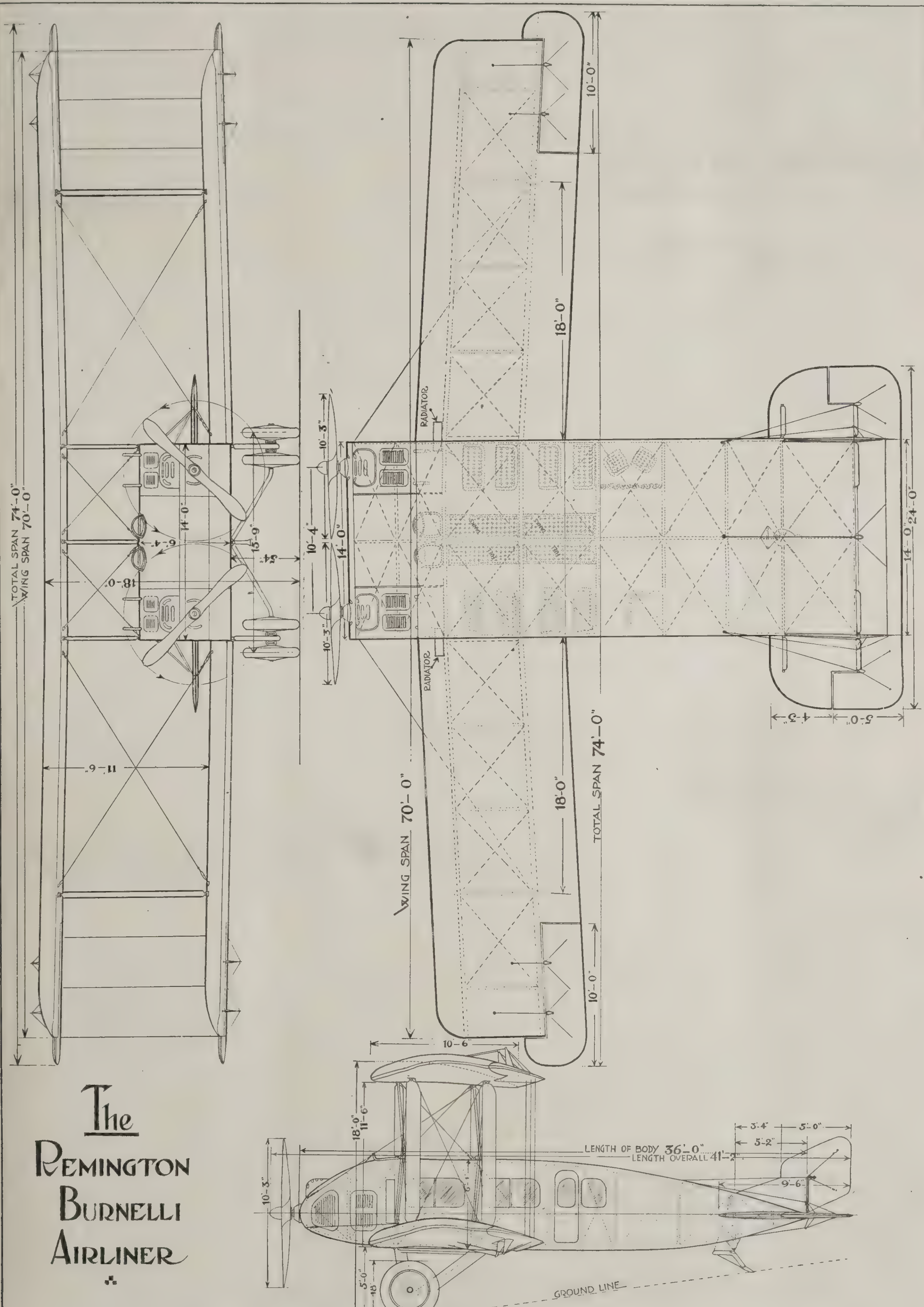
Length overall	41′ 2″
Height	18′ 0″
Span	74′ 0″
Chord	10′ 6″
Aspect Ratio—Wings	6.66 2/3
Aspect Ratio—Fuselage	.39
Wing Section	M-2
Fuselage Section	Special
Gap	11′ 6″
Angle of Incidence	2°
Dihedral	1°
Sweepback	3°
Load per Square Foot	9 lbs.
Load per Horse Power (one motor)	30-(15 lbs.)
Horse Power	1000 h.p.
Fuel Capacity	430 gal.
Climb	900 Ft. per Min.
Ceiling	14000 Ft.
Speed Maximum	110 M.P.H.
Cruising Speed	96 M.P.H.
Landing Speed	50 M.P.H.
Duration	8 Hrs.

Areas

Upper Wing	735 Sq. Ft.
Lower Wing	588 Sq. Ft.
Fuselage	504 Sq. Ft.
Total Lifting Surface	1,827 Sq. Ft.
Ailerons	124 Sq. Ft.
Stabilizers	50 Sq. Ft.

(*Concluded on page 416*)

Three-quarter view of the Remington-Burnelli 30 passenger airliner



The Remington Burnelli Airliner

FOREIGN TECHNICAL DIGEST

Sparking Plug with Revolving Electrode

The central electrode is made of a nickel alloy, and shaped like a fan; the movement of the gases in the cylinder is said to cause it to rotate. This gives a circle of flame instead of a spark from a single point, causes a poor mixture to ignite more easily, and is self-cleaning. (*Revue Automobile*, Nov.-Dec., 1920. 1 col., 1 fig.)

The Dornier Twin-Engined Monoplane, Type G. 1

Generally speaking this Dornier resembles previous ones in the shape of its monoplane wing, *fuselage*, and tail. It differs, however, in that it is provided with two engines placed very low at the outer ends of the usual Dornier wing roots growing out of the lower portion of the *fuselage*. The latter projects only a short distance in front of the leading edge of the plane, thereby making it possible to bring close together the two engines, which, as a matter of fact, are only sufficiently far apart to prevent their tips touching. Evidently the object of this arrangement is to reduce to a minimum the turning couple set up in case one of the engines stops.

The undercarriage is of the simplest possible type, consisting of one large wheel on each side, placed immediately underneath the engines. The weight of the *fuselage* with its contents and of a portion of the wing, is transmitted to the wheels by the deep section wing roots, to the ends of which the engines are attached. The wing itself is braced by two tubes of streamline section on each side, supporting the non-tapering monoplane, which is of the usual rectangular plan form.

The general construction, as usual in Donier practice, consists of steel members for all heavily stressed parts, and duralumin for the details taking small loads only, and for the covering.

Owing to the general arrangement of the machine, one imagines that it would be comparatively safe in the case of a crash, as the engines are slightly below and well ahead of the cabin. The petrol tanks are placed inside the wing, one on each side, so as to give gravity feed to the engines, but yet being, it is claimed, sufficiently far removed from them to ensure that no petrol could possibly leak down on to the hot engines.

So far as we are aware, no provision has been made for enabling passengers to get out through the roof, in case the door should be jammed, but if found necessary, this could easily be arranged for in the rear portion of the cabin, where the trailing edge of the wing could be cut away, probably without serious loss in aerodynamic efficiency. On the whole, the machine, which is designed to carry eight passengers in addition to the pilot, impresses one as being of rather promising design, and it will be interesting to see how the machine behaves in actual use. The B.M.W. engines have a reputation for reliability and exceptionally economic fuel consumption, and, rating the engines at 200 h.p. each, the machine carries a passenger for each 50 h.p., which should be a fairly economic proposition, especially coupled with the fact that the machine has a cruising speed of over 90 miles per hour.

Following is a brief specification of the Dornier G1:

Length o.a. ....40 ft. 0 in.
Span ....68 ft. 10 ins.
Chord ....13 ft. 1½ ins.
Height ....10 ft. 10 ins.
Wing area ....862 sq. ft.
Engines ....2 B.M.W., 185 h.p. each
Fuel consumption at full speed: Petrol, 172 lbs.; oil, 9 lbs. per hour.
At cruising speed: Petrol, 132 lbs; oil, 9 lbs. per hour.
Weight empty but with water...5,170 lbs.
Weight fully loaded............7,600 lbs.
Weight per sq. ft.................8.8 lbs.
Weight per h.p. (nominal)......20.5 lbs.
Maximum speed ....112 m.p.h.
Cruising speed ....93 m.p.h.
Ceiling (with full load)........19,700 ft.

(*Flight*, June 9, 1920.)

D. F. W. Aero Limousine

A new passenger machine embodying all comforts and protection for three pessengers has been built by the D.F.W. Co. The fuselage is of wood with detachable wings with steel rudders, steel landing frame and springs. A 260 h.p. Benz motor is used. Total weight for 600 km. flight, 1,470 kgm.; span, 13.6 m.; length, 7.3 m.; height overall, 3.0 m.; wing area, 38 sq. m.; speed, 150 km./hour; maximum altitude, 5,500 m. (*Aeronautics*, June 9, 1921.)

Carburetion in Internal Combustion Engines

M. C. Faroux explains in this article the formation of water in the induction pipe of petrol engines and also in the fuel tanks.

Condensation of moisture on the induction pipe is frequently met with in cold weather on motor cars, and is quite common on aero engines on account of the altitudes at which they operate. For this reason, the induction pipe is often provided with a heated jacket, the heat being supplied by the cooling water or the exhaust gases. In vaporizing the fuel a considerable quantity of heat is absorbed, this quantity being $q = 109 + 0.244\ t - 0.00013\ t^3$ where t is the temperature of the liquid. Thus with petrol at 0°, the evaporation of 1 kg. requires 109 large calories, and with the theoretical quantity of air, 9-11 cu. m., for complete combustion, the evaporation of the fuel is capable of lowering the temperature of the mixture some 25° to 30°. Condensation on the outside of the induction pipe and the formation of ice crystals inside is therefore quite possible with an atmospheric temperature above 0°. Choking of the carbureter jets is often due to the presence of fine particles of ice formed in the induction pipe.

It is certain that in cold weather, water is formed by condensation and deposited on the surface of the petrol in the tank of motor cars and aeroplanes. During flight the fuel and the walls of the tank are lowered in temperature, and if, after landing, the tank is left open to the atmosphere, water vapor is precipitated from the air owing to the temperature difference. By slowly pouring 10 kg. of petrol which has been cooled to —15° C. into a tank, the atmospheric temperature being 15° C., some 7 grm. of water may be condensed and deposited in the tank. (C. Faroux, *La Vie Automobile*, Jan. 10, 1921. 6 cols.)

Duralumin Motor Boats

The Zeppelin Works of Staaken, Germany, have now placed on the market motor boats made completely of duralumin. The advantages of the use of this metal for construction are many, among the principal being lightness combined with strength. This metal is not affected by heat, cold, snow, sea-water, etc. It is proposed to use such boats as lifeboats on ships. Descriptions of various types of boats are given, and the most notable feature of them is the small power of engine required to propel quite a large boat at comparatively high speed. A 33-ft. cabin cruiser having a beam of 7 ft. 6 in., and draught (aft) 2 ft. 4 in., has only a 4-cylinder 14 b.h.p. engine to give it 11 knots. The fuel consumption is 9¼ lb. per hr. (petrol). (*Auto Liga*, Feb. 12, 1921. 2 pp., 4 figs.)

New Italian Tourist Aeroplane

The Italian Breda Co., who during the last year of the war constructed Caproni aeroplanes and Spa type engines, is at the present time manufacturnig a small tourist 2-seater triplane, which has the following dimensions:

Span of wings...... 6.00 m.
Length .... 5.60 m.
Depth of wing...... 1.00 m.
Carrying surface...16.00 sq. m.
Weight (empty)...330 kg. (about)
Useful load.......270 kg.
Total weight......600 kg.
Load per sk. m.... 37.8 kg.
Load per h.p...... 6.66 kg.
Engine ....1 type Breda h.p. 90-110
Speed at low altitude. 130 km. per hour
Landing speed....... 55 km. per hour
Climbing times at 2,000 m. in 18 minutes
Autonomy hours... 2.30
Factor of safety... 13

The Fiat 3-Seater 300 H.P. Aeroplane A.1.

The following are the chief characteristics of this new Italian aeroplane:

Span of wings....... 14.00 m.
Depth of wing....... 2.00 m.
Length .... 8.70 m.
Height .... 3.25 m.
Weight at full load...2,050 kg.
Weight (empty) ....1,450 kg.
Normal useful load.. 600 kg.
Load per sq. m..... 35.50 kg.
Load per h.p....... 6.85 kg.
Carrying surface..... 52 sq. m.
Engine...Fiat A.12 bis 300 h.p. at 1,600 r.p.m
Factor of safety..... 9
Speed at low altitude. 180 km. per hour
Landing speed....... 90 km. per hour
Theoretical ceiling...4,500 m.
Climbing time ...At 2,000 m. in 13 minutes
At 3,000 m. in 25 minutes
Autonomy ....Normal hours 3.30
Maximum hours 5.30

In the useful load the transportation of passengers may be substituted by corresponding loads of postal matter.

NAVAL and MILITARY AERONAUTICS

McCrary in Commond at North Island

Commander Frank McCrary has been placed in command of the naval air station at North Island, San Diego.

Although still a comparatively young man, Commander McCrary has risen to a very responsible position in the world of naval affairs, and he is very popular with officers and men with whom he has come in contact during the 20 years of his naval service.

He was appointed to the Naval Academy in 1897, saw service in the Spanish-American war, and was graduated with honors from the academy in 1901. He was commissioned ensign in 1903, and before the outbreak of the world war held the rank of lieutenant.

In 1917 he was placed in charge of the Lighter-than-Air Department at Pensacola, and in this capacity demonstrated his aptitude for aviation work. A number of the men on the station were at Pensacola at the same time as Commander McCrary.

In September, 1917, he was assigned to the office of chief of naval operations for duty and a few months later was placed in command of U. S. Naval Aviation forces in Ireland. There he again demonstrated his efficiency, and in addition won the love and respect of all his officers and men.

After the war, Commander McCrary was for a time in charge of aviation instruction at the Naval Academy, going from the academy to the U. S. S. Idaho as executive officer.

Commander McCrary is characterized as a man of striking personality and it is predicted by officers and men alike, that his administration of the Naval Air Station will be a most efficient and popular one.

Personal Pars

Major Pearson Menoher, U. S. A., and Mrs. Menoher announce the arrival of a son, Pearson Tuthill Menoher, at Fort Huachuca, Ariz. The baby is a grandson of Major General Charles T. Menoher, Chief of Air Service, and also of Mrs. William Hector Tuthill, of West 6th St., Los Angeles, Cal.

Lieut.-Col. C. C. Culver, U. S. A., one of the best known officers in the Air Service, has just been honored by the University of Nebraska in an election to the Scientific Society of Sigma Xi. This is in recognition of Lieutenant-Colonel Culver's work in the application of radio telegraph and telephone to aircraft, and in the development of voice-commanded flying. Election to membership in this society is regarded by scientists as tantamount to the conferring of a university honorary degree and considered a great distinction.

The Air Service Library

"Special Libraries" for May contains an article by Major H. M. Hickam, A. S., Chief of Information Group, of the Army Air Service on the subject, "The Air Service Library." Editorial comment which prefaces the article says that while Major Hickam makes it quite clear that this library, although, as he points out, one of the newest Government libraries, is well on the road toward ranking not only with the other great libraries of Washington, but with aeronautical libraries everywhere.

The article sets forth in part:

Although the Air Service library is one of the most recently organized in the entire War Department, it is rapidly becoming an important technical and general library on matters pertaining to this branch of the service.

The nucleus of the library came with the transfer of the "Aviation Section of the Signal Corps of the Army," which, on May 20, 1918, became the Division of Military Aeronautics, "charged with the operation and maintenance of all military aircraft," and the Bureau of Aircraft Production, "charged with complete and exclusive jurisdiction and control over the production of aeroplanes, aeroplane engines and equipment for the use of the Army, and all books, records and office equipment." By Act of Congress of June 4, 1920, the Air Service as it now functions was created.

The Air Service library is charged with the procurement of all books and magazines for all activities of the Air Service both for the local library and for sixty-two aviation fields throughout the country; gathering and making accessible for reference purposes the originals of all documents of the Air Service; gathering and maintaining for reference purposes the original print of all Air Service photographs, both foreign and domestic; the collecting of foreign and domestic information on all aeronautical subjects; receiving and routing of all M.I.D. Air Service material, and maintaining liaison between the Air Service and Military Intelligence Division; production or procurement of all slides and films of the Air Service to be used for instructional and historical purposes; collecting and making accessible sets of blue prints for every accepted type of aeroplane engine or aeroplane part, the aim being to make this the best aeronautical reference library in existence.

In August, 1918, the actual work of organizing the library was begun, and, at this time, there are classified and catalogued and immediately accessible, 2,500 standard books on aeronautical and allied subjects; 16,000 original documents; about 40,000 photographs, and 2,000 films and slides, together with a large collection of blue prints of aeroplane engines and parts, and an invaluable collection of clippings.

The library subscribes to the best aeronautical periodicals, and now receives regularly 166 English and American journals, and 30 in seven foreign languages. These magazines are analyzed immediately on receipt, and although this analyzing has been done for only a few months past, about 5,0000 index cards have been made, thus making the latest aeronautical news immediately accessible.

Such, roughly sketched, are the resources that the Air Service library of the U. S. Army offers to the research worker: a collection of aeronautical information not to be duplicated elsewhere, catalogued and filed after approved methods and available for immediate reference.

Changes of Stations of Officers

June 11, 1921—Captain Chester W. Gates relieved from duty with the Air Service at Carlstrom Field, Arcadia, Florida, and returned to the Quartermaster Corps.

June 15, 1921—First Lieutenant Edwin G. Shrader detailed to the Air Service and ordered to Carlstrom Field, Arcadia, Florida, reporting not later than July 28, 1921, for duty and pilot training.

June 15, 1921—The following officers ordered from places indicated to places indicated for duty:

Major Walter W. Vautsmeier—March Field, Calif., Ross Field, Calif.

Major Barton K. Yount, March Field, Calif., Washington, D. C.

Major Delos C. Emmons—Harvard University, Dayton, Ohio.

Major Douglas B. Netherwood—San Antonio, Texas, Americus, Ga.

Captain James F. Doherty—Washington, D. C., Middletown, Pa.

First Lieutenant Edwin R. Page—Carlstrom Field, Washington, D. C.

First Lieutenant Hjalmar F. Carlson—Carlstrom Field, Montgomery, Ala.

First Lieutenant Clements McMullen, Montgomery, Ala., Carlstrom Field.

Lawrence Sperry on Parachutes

In line with the controversy which has been going on recently in the columns of the News Letter relative to the use of parachutes, the following letter from Lawrence B. Sperry, of the Lawrence Sperry Aircraft Company, Inc., addressed to Major Edward L. Hoffman, Chief Equipment Section, McCook Field, Dayton, Ohio, will be of interest. The letter which bears the date of June 9 is as follows:

A short time ago I tested out a new ship and used one of your seat packs, putting it through everything at 3,000 feet. It was a nice feeling to have the pack with me—had anything gone wrong, such as violent aileron flutter, overbalanced flippers, or an unrecoverable condition of stability in an upside-down position, the result would not have been the usual notice of "killed testing a new aero."

The other week I got Bert Acosta to wear the chute. First he hesitated, then put it on, which all goes to show that there is gradually becoming less and less opposition to the use of parachutes.

We are going to have a rule in this factory as soon as we get enough chutes that every one flying shall wear a parachute. We have three 20-ft. chutes that were made out of strong silk and also with strong shroud lines. Having tested them from a DeHaviland at high speed, I was thinking of making up three seat packs using these chutes.

I noticed your remarks in the News Letter about carrying parachutes, which are certainly very much to the point. I am looking forward to the day when the Air Service will require every pilot to wear a parachute.

FOREIGN NEWS

A New Supermarine Amphibian

For some time it has been known that the Supermarine Aviation Works of Southampton have been engaged on the construction of a new amphibian machine for the Air Ministry. We now learn that the machine has been completed, and has successfully undergone her tests. The shore landings made last week on one of the R.A.F. aerodromes proved the new amphibian gear to be very effective, and a considerable improvement on previous one. On the sea also the machine behaved in the typical Supermarine way, and the machine has now been taken over by the Air Ministry, being flown from Southampton to Isle of Grain by a Service pilot in a non-stop flight. As the machine is the property of the Air Ministry, no details can be published.

Civil Air Services in French Guiana

At present six hydro-aeroplanes are running a regular service between Saint-Laurent du Maroni and Cayenne (260 km.) and Paramaribo (Dutch Guiana), a distance of 250 km., and air transport has become popular, both for passengers and goods. Carriage of goods is very remunerative, as people prefer to send gold, balata, essence of rose, etc., by aircraft, which cover the distance from Saint-Laurent to Cayenne in six hours, whereas by canoe the time taken is twenty days.

Within a short time the three Guianas are to be linked up by a regular air system, which will enormously facilitate intercommunication.

Civil Air Service in Argentina

The Argentine Army Aviation authorities have submitted to the Government a project for the establishment of air services throughout the Republic. The central station will be at El Palomar, near Buenos Aires, and the principal outlying stations at Monte Caseros, Cordoba, Neuquen, Salta, Mendoza, and Gallegos.

Twenty-two secondary stations and 126 landing grounds are projected, so placed that an aeroplane will at any time be within 70 kiloms. of a landing ground. Altogether a very ambitious beginning. To further help things along, private individuals are invited to offer gratuitously to the Government, land suitable for use as landing grounds.

Dutch Government Helping Commercial Flying

It has been decided by the Dutch Government to place the one-time naval-flying station of Veere, in the Province of Zealand, which has a seaplane harbor, at the disposal of the Fokker Company.

Strange Air Cargoes

To English travellers and residents on the Continent who prefer English food the air services prove a distinct boon.

"Regular consignments are handed in here daily," said Mr. J. L. Wakeman, manager of the freight department of LepAerial Travel Bureau last week. "Sir Basil Zaharoff has a jar of cream sent to his Paris address every other day, while rolls of bread served at Claridge's Hotel so charm the palate of another Parisian that he has half a dozen sent over daily."

The Pescara Helicopter

From Barcelona it is reported that the Pescara helicopter has been tested in the garden of its inventor. Although weighing a matter of 880 kilograms (1,760 lb.), and having an engine of 120 h.p. only, the machine is said to have risen easily, and to have remained at a height of one foot for a considerable time. One presumes that the height attained does not represent the ceiling of the machine, but that she was kept there by anchoring arrangements of some sort. Later M. Pescara intends to have the machine transferred to the Barcelona aerodrome for the official tests.

Cairo-Basra Air Scheme

The British Government is interesting itself in a scheme for the development of a regular service of commercial aeroplanes between Cairo and the head of the Persian Gulf, says the *Times* aeronautical correspondent, who understands that a fleet of first-class commercial aeroplanes will be employed on the route, and that the first steps in the development of the scheme have already been taken.

Part of the route over which the aircraft will ply is already served by the Baghdad Railway, which at present is working only on somewhat restricted portions of its line. Basra will probably be the Eastern terminus of the aerial route, which may be expected to touch Baghdad, Damascus and Jerusalem. The development is not altogether surprising when read in the light of Mr. Churchill's recent visit to Egypt, the fact that he is now at the Colonial Office, and his consistent interest in flying.

Airways Where No Roads Exist

It is reported that the directors of the Forminiere Diamond Mines Co. have suggested the inauguration of an air service by seaplane, which would operate between the mines of Djoko Punda, on the Kasai (a tributary of the Kongo), and Kinchassa, on the Kongo, from which latter point the railroad runs to Matadinoki, a steamer port on the lower Kongo. The directors offer to defray the greater part of the initial cost of the scheme. In the meantime a survey of the route is being undertaken. The distance from Kinchassa to the mines is approximately 500 miles, which could be covered in two days, as contrasted with over a month by the existing river transport.

In French Guiana

From French Guiana comes another lesson. Along the River Maroni are valuable gold and forest workings, which have hitherto been handicapped constantly by the slowness and discomfort of the river transport, effected mainly by canoe. Passengers and goods, owing to the rapids, have to handled frequently on the river banks, and then re-embarked. Now, however, by a service of French seaplanes, a voyage up the Maroni, which takes some 20 days by canoe, can be accomplished in a few hours by air.

Apart from the benefit which the Dominion Prime Ministers can bring to their own territories by the introduction in suitable districts of connecting "airways" says the London *Times*, "the starting of such services, and the provision of machines and equipment for them, is of vital interest to the aircraft industry. Designers and constructors are in a position to provide seaplanes and flying-boats for coastal, river, or inter-island flying. There is being developed a new school of design in comparatively slow-flying, big-load transport aeroplanes which would be particularly useful for work overseas; and a newly developed craft like the "amphibian", capable of rising from or alighting on, either land or water, should be especially interesting to some of the Dominions.

"It is to be hoped, therefore, that no opportunity will be missed of bringing into the closest touch those who can use transport-aircraft overseas and those who can provide for them."

Ecuador-Colombia Air Mail

An "air mail" has been carried from Carchi in Ecuador to Pasto in Colombia by Signor Guicciardi, an Italian pilot, this being the first mail by plane between the two republics.

Australia Asking for Air-Tenders

In connection with the proposed Australian weekly aerial service between Geraldton and Derby, a distance of about 1,200 miles, it is announced that the Federal Government is asking for tenders to run it. £25,000 is the maximum expenditure fixed upon per yearly contract.

Mexican Service

Plans will soon materialize for a commercial air service between Cuidad Juarez and Chihuahua City. The distance between these two points is 226 miles by rail, and the journey takes 10 hours. The wagon roads are so bad that a long detour through Fabens, Tex., is necessary, and even with a good automobile it takes about 12 hours to make the trip. The aeroplanes of the new service will easily make the journey in two hours. It is proposed later, states Consul J. W. Dye, to make special flights throughout the State of Chihuahua for the accommodation of mine owners and others. American planes piloted by Americans will be used, and pending the selection of a landing field at Juarez, permission has been granted for the use of Fort Bliss, near El Paso, Texas, across the border from Juarez.

Commercial Aviation in Bolivia

Bolivia was among the earlier South American supporters of aviation, especially for commercial purposes. Towards the end of last year the Government formed the first school of aviation, contracting with Lieut. Donald Hudson, an American aviator, to act as director of the Institute. Since then, the Administration, although having been changed from one political side to the other, has maintained its interest in aerial transportation. A recent action has been the recognition of, and support for, a new aviation society known as *La Sociedad Boliviana de Transportes Aeros,* which has been formed upon an ambitious scale to promote commercial aviation throughout the country. The Government has given to the new undertaking the right to operate an air-line between Cochabamba and Santa Cruz. For this purpose there will be put into use four triplanes of the newest type, capable of carrying 10 passengers and 1,000 kilos of cargo, the journey between the two points mentioned being estimated to occupy six hours. The headquarters of the new aviation society will be established at Cochabamba. It may be recalled that in the month of May, 1920, the first public exhibition of flying was held in Bolivia, upon which occasion Lieut. Donald Hudson ascended 1,000 meters above La Paz, thus reaching a height above sea-level of 5,180 meters.

Colombian Services

The Republic of Colombia is commercially interested in the regulation of aviation, in which a number of foreigners are taking active part. The Government has now issued a decree which classifies privately-owned aircraft into two sections according to their use, either as touring or commercial aircraft. All flying machines entering the country are registered, and the utmost care taken to see that no flights are undertaken until the machine has been thoroughly tested. Aircraft which are the property of the Government are to be employed exclusively for military purposes, carrying the mails, for the Customs, and police forces. Private aviation companies already established or to be established in the territory of the Republic will be considered as national, while all private aircraft, whether used for touring or commercial purposes, will bear the same designation. Private aircraft companies will be obliged to give a declaration to the Ministry of War to the effect that they will comply with the rules for aviation now accepted.

German capital has already been interested in connection with commercial flying, a company subscribed to by local Teutons having a capital of $100,000. It is proposed to extend the local service, which hitherto has not done very much in the direction of practical flying, from Barranquilla as far as the Dutch Port of Curacao, opposite the territory of Venezuela. Each machine is destined to carry five passengers and 1,000 kilos of cargo. Planes have been purchased upon the recommendation of Herr Kamerer, an aviation engineer, under whose instruction also hangars and workshops have been partially completed at Barranquilla. In the meantime arrangements are being made to inaugurate an aeroplane service between Barranquilla and Girardot, about 700 miles up the Magdalena River, a journey which is expected to occupy nine hours, including a number of short calls at various towns passed en route. This service will be for both passengers and cargo.

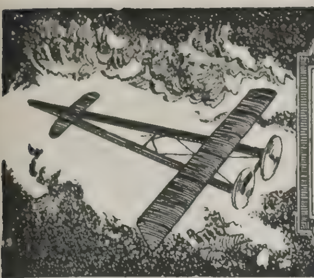
Sale of Italian Material

Lt. Col. A. Guidoni, Italian Air Attache, has informed the Chief of Air Service that, owing to the fact that certain unreliable concerns having purchased old and used aeronautical material which they, in turn, have marketed as new, the War Department of Italy, through the Superior Command for Aeronautics, has issued the following statement:

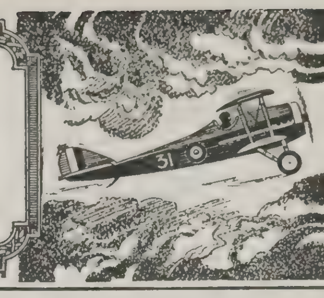
"For the information of all concerned, the War Department (Superior Command for Aeronautics) announces that no individual or agency has been charged with the sale of aeronautical material belonging to the Government whether residue from the war or otherwise, but instead the Department will provide for the sale of such surplus material directly or through the 6th committee of Alienation.

"Regarding certain material previously sold and later used for speculative purposes and represented as in flying condition without the necessary inspection by technical specialists, the War Department announces that the Government cannot give any guarantee of the efficiency of such material, as it will guarantee only such material as has been sold directly or through the 6th committee of Alienation, and for which certificates of navigation have been issued.

"This statement is also for the protection of the good name of the Italian Aeronautical Construction Industry."



ELEMENTARY AERONAUTICS *and* MODEL NOTES



CLUBS

PACIFIC MODEL AERO CLUB
240 11th Avenue, San Francisco, Cal.
Portland Chapter: c/o J. Clark, Hotel Nortonia, Portland, Ore.

PACIFIC N. W. MODEL AERO CLUB
921 Ravenna Blvd., Seattle, Wash.

INDIANA UNIV. AERO SCIENCE CLUB
Bloomington, Indiana

BROADWAY MODEL AERO CLUB
931 North Broadway, Baltimore, Md.

PASADENA ELEM. AERONAUTICS CLUB
Pasadena High School, Pasadena, Cal.

NEBRASKA MODEL AERO CLUB
Lincoln, Nebraska

BUFFALO AERO SCIENCE CLUB
c/o C. Weyand, 48 Dodge St., Buffalo, N. Y.

ILLINOIS MODEL AERO CLUB
Room 130, Auditorium Hotel, Chicago, Ill.

SCOUT MODEL AERO CLUB
304 Chamber of Commerce Bldg., Indianapolis, Indiana

MILWAUKEE MODEL AERO CLUB
455 Murray Ave., Milwaukee, Wis.

MODEL AERO CLUB OF OXFORD
Oxford, Pa.

CAPITOL MODEL AERO CLUB
1726 M St., N. W., Washington, D. C.

AERO SCIENCE CLUB OF AMERICA
Beach Bldg., E. 23rd St., New York City

AERO CLUB OF LANE TECH. H. S.
Sedgwick & Division Sts., Chicago, Ill.

LITTLE ROCK MODEL AERO CLUB
1813 W. 7th St., Little Rock, Ark.

The Fastje Compressed-Air Motored Model

THE tractor monoplane compressed-air motored model, designed by C. H. Fastje, of Dennison, Iowa, conforms to the following specifications:

Wing span	5′ 0″
Wing chord	9″
Wing curve	U. S. A. # 5
Incidence angle	4 degrees
Propeller diameter	15″
Engine type	2-cylinder opposed
Weight complete	18.75 oz.

The main planes have solid balsa wood ribs which are double surfaced. Japanese silk is used for the covering. The trailing edges of the wing and tail surfaces are of fine wire which gives the scalloped appearance. The leading edges are of ⅛-inch round split bamboo. Ribs are of balsa wood and main spars of ¼-inch round dowels. The main planes are set with four degrees incidence, but the tail plane is set at zero angle.

The compressed air tank, which is of streamline form, was constructed to hold air at 150 pounds pressure, a safety valve being attached so as to limit it to that amount. Although a satisfactory pump has not been found which would permit the tank to be filled to its maximum capacity, it has held 100 pounds of pressure, sufficient to make the machine rise from the ground and fly a short distance. Better results are expected when the tank is filled to capacity. Experiments are also to be made in adopting a propeller which will give the best flying results.

In attaching the tank to the framework, instead of running two small threaded rods through each longeron and soldering them to the tank, attachment is made by fastening a strip of sheet aluminum 1/32 inch by ¼ inch wide on the bottom and top of each end of the tank. This method eliminates the usual piercing of the tank, yet it holds firmly. The aluminum bands are bolted to the longerons with 1/16-inch threaded rod.

An Idea for Electric Driven Models

Mr. A. B. Weddington, of Meriden, Miss., has originated a scheme for tethering an electrically driven model that is both simple and practical. The model is to be driven by a miniature electric motor, the current for which is supplied through wires lead through a hollow rod. The upper end of the rod will travel with the model and the lower end is pivoted at an anchor supplied with ball bearings. There could be one or two feet of the wire exposed between the upper end of the rod and the model. A very small electric motor, deriving its current from dry batteries, can be used.

The success of this idea depends upon the use of a motor developing sufficient power to fly the plane. The model would have practically nothing to lift except its own weight, as the rigid hollow rod traveling around in the same circle would carry its own weight and the weight of the wires.

Advisory Committee Issues Pamphlet on Wing Sections

The investigations of aerodynamic laboratories of the United States and Europe, upon the subject of aerofoils for aircraft, are covered in a recent report issued by the American National Advisory Committee for Aeronautics. In this report the results of tests made on wing sections by the leading laboratories of America, England, France, and Italy, are brought together in a handy form arranged to be very useful to designers and others who would have occasion to use them for reference. The collection contains reports on all existing aerofoil tests.

Profiles are given of each section with dimensions at stations along the chord. The actual shape of the section is shown with a sufficient degree of accuracy to make possible a visualization of the section whilst its characteristics are being considered.

A separate data sheet is included for each of the sections. These data sheets enable one to obtain more accurately the dimensions of the outlines, as they list an additional decimal place for most of the ordinates.

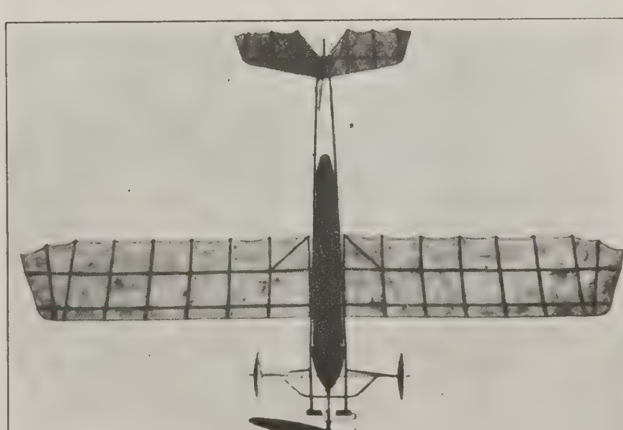
The classification of the wings, according to their aerodynamical and structural properties, is given in four index charts, so that designers can easily select the wing section best suited to his requirements. Another index is arranged according to the order of the curve sheets, by countries and laboratories where tests were conducted. Designation is also made by reference numbers and an alphabetical index.

Students will find the report of the highest possible value. It contains complete data upon 214 aerofoils. A copy of the above mentioned report may be obtained upon request to the National Advisory Committee for Aeronautics, 2722 Navy Building, Washington, D. C.

How to Repair Leaks in Model Floats

Melted paraffin has been used successfully in mending pontoons that have become damaged. An ordinary paraffin candle is the most convenient form to use and one is so readily carried in the model builder's tool kit that flights need never be delayed on account of cracked or split floats. In model contests, where time is limited, such a repair may mean that the flyer's chances of winning are increased.

Best results are obtained only when the region to be mended is thoroughly dry and free from grease, varnish, etc. On a varnished surface, scrape away the varnish all around the portion to be mended and allow a drop of melted paraffin to fall upon it; spread the paraffin with the finger before it cools. The pontoon is immediately mended temporarily in this manner if it has not been too badly damaged for use; often a patch of this kind can be so well applied that the float is permanently mended and of course the paraffin is entirely water-proof.



The Fastje Compressed-Air Driven Tractor Monoplane

Wotta Lot He Knew!

A man and his small boy, aged six, were walking down the street one day when a female of the colored species approached them. The little boy exclaimed:

"Oh, daddy; that lady's got a black face!"

"Yes, sonny; she's black all over."

"Oh, daddy, what a lot you know!"

"Times aren't so bad," remarked the Seaman Twice. "Why, even today one can get a good chicken dinner for 20 cents."

"Where at?" asked the Bosun's Mate, as he reached for an anchor bar.

"At any feed store," replied the S. T.

Slow music and military honors.—Exchange.

Not Hard to Please

Anderson: "I suppose you are going to marry a girl with a yacht, now that you are a sailor?"

Batch: "Oh, if I really loved the girl I would be satisfied with a little smack occasionally."

The Lamb Again

Mary had a little lamb
  That turned out to be a goat.
Now Mary doesn't give a d——n—
  She's turned it to a coat.

The following was heard in the carpenter shop. There was a certain foreign twang to the male voice, reminding one of Chief Jake:

"It is 'plane' that I love you," he said.

"Is it on the 'level'?" she asked.

"Haven't I always been on the 'level' with you?" he urged.

"But you have so many 'vices'," she remonstrated.

"Not a 'bit' of it," he asserted.

"What made you 'brace' up?" she queried, coquettishly.

"The fact that I 'saw' you," he replied with a bow.

"I ought to 'hammer' you for that," she answered saucily.

"Come and sit by me on the 'bench'," he urged.

"Suppose the others should 'file' in?" she demurred.

"Let me 'clamp' you to my heart," he pleaded.

"You shouldn't let your arms 'compass' me," she replied.

"I know a preacher who is a good 'joiner'," he suggested.

"Promise me not to 'chisel' him out of his fee," she requested.

"That wouldn't 'augur' well for us," he answered.

If you have a bit of news
    —Send it in!
Or a joke that will amuse
    —Send it in!
A story that is new
We want to hear from you,
    —Send it in!
Never mind about your style,
If it's only worth the while,
    send it in!

—Exchange.

In the Clouds

A little volume of poems by Flight Commander Jeffery Day has been published in England, which convey the impressions of his first flight. Day won the D. S. C. at the age of 22, and was killed in aerial combat with six German planes:

"In the clouds—

"The wing-tips, faint and dripping, dimly show,
  Blurred by the wreaths of mist that intervene;
Weird, half-seen shadows flicker to and fro
  Across the pallid fog-bank's blinding screen."

"Then engine stops: a pleasant silence reigns—
  Silence, not broken, but intensified
By the soft, sleepy wire's insistent strains,
  That rise and fall, as with a sweeping glide
I slither down the well-oiled slides of space
Towards a lower, less enchanted place."

Nor does he fail in his gallant attempt to convey in metre the illusion of actual flight:

"My turning wing inclines towards the ground;
  The ground itself glides up with graceful swing,
And at the plane's far tip twirls slowly round
Then drops from sight again beneath the wing,
  To slip away serenely as before,
  A cubist-patterned carpet on the floor.
Hills gently sink and valleys gently fill;
  The flattened fields grow infinitely small;
Slowly they pass beneath, and slower still,
  Until they hardly seem to move at all."

Insulted Maiden—Oh, sir, help catch that man—he tried to kiss me."

Genial Passerby—That's all right—there'll be another along in a minute.

—Purple Cow.

Irate Passenger—Why don't you put your foot where it belongs?

Tough Guy—If I did you wouldn't sit down for a week

—Jester.

When Eve passed the luscious fruit
  Then clothing came in style.
We'll have to pass the fruit again
  In a short, short while.

—Sun Dodger.

Gentleman (at the door)—Is May in?

Maid (haughtily)—May who?

Gentleman (peeved)—Mayonnaise!

Maid (shutting the door)—Mayonnaise is dressing!

(Business of falling down steps.)

—Voo Doo.

"An' phwat are ye thinking of callin' the bit of a baby, Mrs. Kelly?"

"I'm not ontoirely sure yet, but I think we'll be after havin' her christened Hazel!"

"And are ye daft, Mrs. Kelly! Here's all the saints in Hivin with beautiful names for ye—an' yer namin' her after a nut!"

—Gargoyle.

AERIAL AGE WEEKLY

VOL. 13, No. 19 JULY 18, 1921 10 CENTS A COPY

Airscape of Dartmouth, England

The Army's Innings

ISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
riptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIII NEW YORK, JULY 11, 1921 No. 19

An Airway Record.

RECENTLY a record was furnished for traffic on the airways from Britain to the Continent. Ninety machines went in or out of Croydon aerodrome, and nearly 400 passengers were carried in addition to large quantities of goods and small quantities of mails. It really appears at last as though the ice is being broken and that the traveling public are beginning to feel some confidence in the airways. Whilst there is no doubt that the excellent performance and splendid figures of the aerial transport companies themselves have gone a long way towards bringing about this feeling in the minds of the general public, there is no doubt at all that a still greater factor in bringing about their increasing popularity is the reduction of fares. People who would not pay $60.00 or even $45.00 to travel from London to Paris, cheerfully pay $30 to $35, with the result that on almost every trip the aircraft carry a full load, and passengers are being turned away daily. So great is the traffic that there is little doubt that the services are at least paying their way—quite apart from any considerations of subsidy. It must, however, be borne in mind that the reduction in fares was only made possible by the grant of this subsidy.

The ZR-2

More than a dozen years ago the United States Army bought the first dirigible to be acquired by any military force. It was made in the United States, from an original design, by that veteran flyer, Major Thomas S. Baldwin, then aviator, aeronaut and parachute jumper. After Captain Baldwin had made his trial flight successfully, the dirigible was accepted by the War Department and stored in Omaha, where it succumbed to disuse and decay.

The Baldwin dirigible was a one-man affair, like the first Wright heavier-than-air machine. Through the war America had the humiliating experience of having to buy aeroplanes from Britain and France because our War Department had not kept up with the times and had not aided American designers, constructors and pilots.

It is another affront to American enterprise that our military establishment must now acquire dirigibles from Britain and Italy after having given the world the first military blimp years ago. Why does this happen? What is the hindrance in Washington to be overcome.

Baldwin, like the Wrights, could never have offered to take up building and experimentation but for the earnings promised by exhibition flying. His first blimp was built not for the army, but for amusement parks, and Glenn H. Curtiss, like many another great name in American aviation, had his initiation as aeronaut and aviator while in service as Captain Baldwin's mechanician.

What a disappointment these purchases abroad of foreign dirigibles must be to the veteran who built and sold the first military blimp and who tried persistently after that time to obtain an appropriation for the considerable expense of constructing a more modern airship, with ideas gained from his own vast experience and from a visit to foreign aerodromes before the war, where he was received with great honor!—*Editorial in N. Y. Tribune.*

The Army's Innings

IN the Army and Navy bombing tests at Norfolk, Va., the Army Air Service will have it first innings on July 13 and 15, when the ex-German destroyer G-102 will be attacked by 250-pound army bombs. The attacking party will consist of twelve Martin Bombers and eleven DH-4's.

Group Commanders will be permitted to fly their planes in any formation and to drop their bombs in any manner from any safe altitude.

The Commander Air Force at the target will notify the base commander two hours before the attack begins whether the weather is suitable for firing on that date.

The Commander Air Force will notify the base commander when each flight has completed its attack and whether the destroyer is still afloat. If the destroyer is sunk, all planes will return to base and discontinue exercises for the day.

After the completion of the bombing by the Army, should the destroyer still be afloat, she will be attacked by the Navy planes.

Destroyers S-132, V-43 and G-102, if not sunk by aircraft, will be attacked by gunfire by destroyers. Destroyer Division 36 will detail the destroyers for this firing.

The ex-German destroyers will be anchored in approximate column formation, approximately 400 yards apart.

The destroyers, one for each ex-German destroyer remaining afloat, will steam past them at battle speed at a range of 5,000 yards opening fire at discretion. The ammunition allowance is 10 rounds of service ammunition per gun per destroyer.

If any destroyers remain afloat at the conclusion of the above firing, a division of battleships, equal to the number of destroyers remaining afloat, selected from the Arizona, Oklahoma and Nevada, will approach from a distance of not less than 10,000 yards and open fire at any desired range outside of 5,000 yards, using secondary battery fire only. The ammunition allowance is 20 rounds of service ammunition per secondary battery gun of one broadside of firing ships.

If any ex-German destroyers remain afloat at the conclusion of the above firing, they will be sunk by depth charges by the North Dakota wrecking party.

The News of the Week

Pacific Ocean Flight Plannned

Sydney, N. S. W.—An aeroplane flight across the Pacific Ocean is to be attempted soon, it was announced recently, by an Australian aviator, Lieut. P. J. Parer, who some time ago flew from England to Sydney.

To raise $75,000 to finance the trans-Pacific attempt, Lieut. Parer has started on an exhibition flight around Australia. It will be possible to follow a chain of islands from Australia two-thirds of the way across, but on the American side of the ocean there will be a long stretch in which there is no land.

The Late Francis Bacon Crocker

Professor Francis Bacon Crocker, co-designer of the Crocker-Hewitt helicopter, died at his home 507 Madison Avenue, New York, July 9th in his sixty-first year.

Professor Crocker was born in New York City, the son of the late Henry Horace Crocker and Mrs. Anne Eldridge Crocker. He was graduated from the School of Mines of Columbia University in 1882. He later founded the School of Electrical Engineering at Columbia University and was head of that school for nearly twenty years.

His most conspicuous contribution to the electrical industry was the commercial motor, the first of which was put into use in 1886. In company with Charles G. Curtiss and Dr. Schuyler S. Wheeler he produced these motors, which were the forerunners of the present electrically driven motors. In addition to his scientific and scholastic work he was active in the commercial applications of electrical equipment, being one of the founders of the C. and C. Company and the Crocker-Wheeler Company, of which he was director at the time of his death.

One of the objects of his long career in the electrical world was to obtain a complete standardization of electrical equipment throughout the world. In connection with this work he was one of the two American delegates to the International Electrotechnical Commission in London.

During the war Professor Crocker was as adviser to the members of the Naval Consulting Board and, in company with Peter Cooper Hewitt, he developed the first helicopter in this country which was capable of flight.

He is survived by a brother, Major David Crocker, and two sisters, Mrs. Henry C. Mortimer and Mrs. G. W. Kelley.

Regains His Speech in Flight

Indian Head, Sask.—A case parallel to that of the American soldier who regained his speech during an aeroplane flight has been brought to light here.

Over a year ago Wilfred Verner lost his power of speech and on July 9 he was given an aeroplane ride at a high altitude. As a result of sharp loops and dives he was ill when he landed, but was able to talk.

New Baby Plane Tested

Bert Acosta flight tested the Maumert "Baby Vamp" biplane at Curtiss Field on July 9.

This plane, of the single seater type, weighs 350 pounds without its passenger, and is capable of a speed of ninety miles an hour. Its fuel tanks hold a hix-hour supply. The wing spread of the Vamp is eighteen feet.

3000 Air Miles at 2½ Years

Little Lorraine Ericson, two and one-half years old, daughter of Mr. and Mrs. F. G. Ericson, of Toronto, has been doing more flying lately. Her latest flights were over New York City, which gives the young lady 3,000 miles to her credit. The earlier flights, which began when Lorraine was nineteen months old, were made in many parts of the United States and Canada.

Britain to Knit Empire by Air

London.—A committee was appointed by the imperial conference, July 5, to consult with the Minister at the head of the Board of Trade, the Air Ministry and the Postoffice Department to consider practical means available for the development of imperial communications by land, sea, air, radio-telegraphy and radio-telephony. This committee is composed of Winston Spencer Churchill, Secretary for the Colonies, as chairman, with one representative each from Canada, Australia, New Zealand, South Africa and India.

The Waterman Racing Monoplane, with OXR Curtiss Motor, with W. D. Waterman, its designer and head of the Waterman Aircraft Mfg. Co.

Interesting Night-Flying Experiments

Aviation experts are still following the example of pioneers like Wilbur Wright in learning from birds how to fly. Now they are taking hints from that stunt-flying expert, the bat, in order to make night flying safer, and experiments already show progress.

Bats can avoid obstacles they cannot see. Experimenters in England blindfolded several bats and released them in a room which was crossed by many wires and divided from another room by a grid containing holes just big enough for a bat to fly through. The bats never touched the wires, and flew through the holes with ease.

The experiment revealed the bat's secret. He emits a continuous note, often inaudible to man's ears. This sound bounds back from any barrier, conveying such accurate information to his sensitive ears that he can map out the space in front of him without any uncertainty.

It is now thought the aeroplane may do the same thing. Instruments are being devised so sensitive that they will record visibly and before the airman's eyes the progressive increase of such sounds as ground or any other object is approached. Information would be supplied equally well in the dark or in mist, and since sound travels twelve to fourteen times faster than the fastest plane, the warning would come in plenty of time to avoid accidents.

Aviette Prize Won

Paris.—Gabriel Poulain, the French champion cyclist, succeeded in winning on July 9 the Peugeot prize of 10,000 francs for the flight of more than ten meters distance and one meter high in a man-driven aeroplane. In an "aviette," which is a bicycle with two wing planes, he four times flew the prescribed distance, his longest flight being more than twelve meters, or about the same number of yards.

Poulain for several years has been devoting himself to the solution of the problem of flight by the power of his own muscles and several times has come near winning a prize. Poulain altered the angle of the small rear plane of his machine and it was this alteration, it seems, that solved the problem.

Poulain made his attempt just after dawn on the smooth road at the entrance to the Longchamps race course. Several members of the Aero Club, donors of the prize and a large company of journalists and photographers were present. A square twenty meters each way was carefully measured off and chalked so as to mark the points at which the "aviette" left the ground and landed. The conditions of the prize stated that the "aviette" must rise one meter from the ground and that two flights must be made in opposite directions.

Poulain, who was confident that this time he was going to succeed, rode his machine at top speed toward the chalked square. As he entered it he released the clutch which throws the wing into proper position and at once the miniature biplane rose from the ground gracefully and steadily to a height of more than a meter. The flight was as steady as that of a

motor-driven aeroplane and Poulain declared afterward that the motion was smoother than when traveling along the ground. When the judges measured the distance between the wheel marks on the chalk they found it lacked only two centimeters of being twelve meters.

Poulain's flight in the opposite direction was not quite so successful, though he succeeded in covering eleven and a half meters. In landing he broke two spokes of the rear wheel.

M. Robert Peugeot declared the prize won, but Poulain wished to make further proof of the powers of his machine. After changing the wheel he started from positions chosen by the judges, and in each case he succeeded in covering the prize-winning distance. His longest flight was the last, of twelve meters thirty-two centimeters.

In order to cover so great a distance Poulain worked up to a speed of forty-five kilometers an hour on the ground. According to his own estimate, the muscular force required for flight is equal to three horse power. The total weight of the machine, with the wings, is seventeen kilograms, or about thirty-seven pounds, and the cyclist himself weighs seventy-four kilograms, or about 165 pounds.

After the flight Poulain declared that he intended to set at work at once on another plane, which, he believes, will enable him to fly 200 to 300 meters. On this machine he will make use of a propeller instead of depending, as he did today, simply on impetus.

Once in the air, Poulain says that not so much power is needed as for the take-off. He says the pedal-worked propeller will be strong enough to continue flight for a considerable distance without fatigue.

The official description of Poulain's "aviette" gives the measurement of the wing surface as twelve meters. The upper plane is six meters long by one meter twenty centimeters, and the lower plane is four meters by one meter twenty-two centimeters. The angle of incidence of the two plances at the moment of leaving the ground was six degrees.

The little machine was built by an aeroplane firm at Nieuwport. The small rear plane is attached to the rear wheel behind the saddle, while the large upper plane is supported above the head of the rider by struts from the frame.

After the flight, M. Robert Peugeot announced that he would give a second prize of 200,000 francs for a further development of the "aivette," the conditions to be announced later.

New Bureau of Standard Tunnel

The Aerodynamic Section of the Bureau of Standards is constructing a new wind tunnel 10 feet in diameter. The design for the tunnel is finished and the material for its construction is being rapidly assembled. The completion of this tunnel will give the Bureau exceptional facilities for all sorts of research work involving the study of the behavior of objects in a windstream.

Fish by Air Delivery

Madrid.—Madrid's daily supply of fish may be brought from the seashore by means of aeroplanes if a plan under discussion is adopted.

Fresh sea food is extremely scarce in the capital at present, and it is to remedy this condition that the aeroplane plan has been suggested.

The journey from the coast would take about three hours instead of the twenty-four required by railroad freight trains.

WHY I QUIT STUNTS

By LT. H. J. RUNSER

IN March, 1919, I started from Toronto, Canada, with a practically new Canuck without any commercial experience whatever. I had been off the stick for six months but hopped in and started for the States to fly and fly and fly.

Well I did fly very successfully through twenty-two of them. I encountered many obstacles, made money and spent the most of it getting experience.

I had an original act which I termed "Falling a Mile in Flames"—it was a real thriller, as I went up about 5,000 feet and kicked her over with belching streams of fire and smoke trailing behind me like a corkscrew for a mile in the sky.

I got good money. I never accepted a contract unless I did get it.

I flew from Delphos, Ohio, in the Canuck across Kentucky, the Cumberland Mountains, a very wild country to fly over, then across the Great Smoky range and finally Mt. Mitchell and the Blue Ridge, landing at Morgantown, N. C., on my way to the North Carolina State Fair in 1919, at Raleigh, N. C.

I was scheduled to give four flights, one each day, and this is why I quit stunts.

I always prided myself on perfect control and big tail spins from 7,000 feet to within several hundred feet of the ground. On the third day of my engagement I kicked opposite rudder at 1,000 feet to bring her out, the air seemed perfect, it being a beautifully and delightfully cool October day.

I spun three times before she took a hold and I saw Mother and thought of one thousand things that had happened in the past, and just as I stiffened my limbs for the final crash I felt her take and I gave it all the stick she could possibly get and waved a greeting to the crowd 30 feet below as I swung up over them.

I got my thinking cap on and mentioned to my partner, Turner, when landing that something was wrong. I knew I had faith in my ability and I knew the ship was inspected thoroughly before going up, as I always examine every cotter and every wire very closely.

I decided right then and there that stunts will get you some day if you stick to them, so I called off stunts, but Lieut. Maynard came to town to visit his home town fair at Clinton, N. C., the following week and nosed the D.H. over in a half-mile track so that left no stunts for the Fair Association. They called on me so I gave them what I said was my last spin and it was November, 1919, and to this day I never have done anything but spiral and glide and fly straight and I know and feel perfectly at ease and think I can fly a plane until I'm seventy years of age.

I believe we were the first to call off stunting. We announced it at the Aero Congress in 1920 at Atlantic City. Scotty Campbell contradicted our views, Miss Laura Bromwell heard our talk but today these two brother and sister fliers have finished, because of stunts.

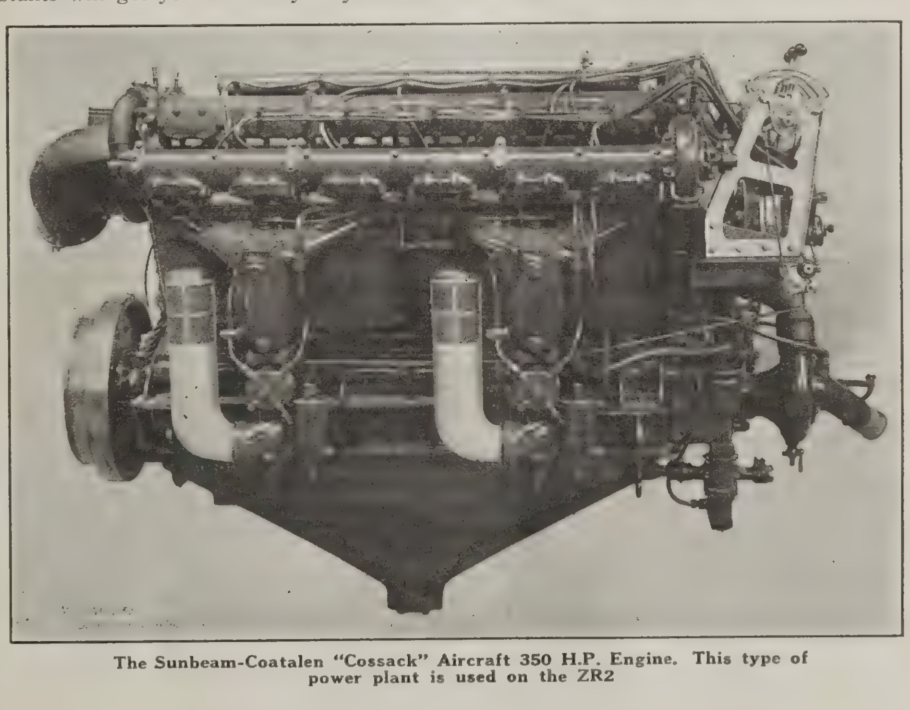
I believe in aviation, I'll die for it and do all the pioneer work necessary to develop it on a safe and sane basis, but I have refused to stunt the ship at any price.

The certain per cent on the ground look upon you as a crazy pilot. We have gone upon the same field time and time again and carried three times the passengers of our brother fliers simply because the public thought we were competent fliers and placed confidence in us because we did not stunt the ship. Instead, Turner would walk over the plane, demonstrating how a plane could be controlled under adverse conditions, but not to thrill the crowd. *The results.* We have been recognized wherever we go as the safe pilots, conservative people; folks of character, prominence and money have given us their support, because we created a desire in them to fly. Prominent families who were absolutely scared to death over the thoughts of an air voyage have turned over their children from 2 years up to fly with us; many bankers of mature age with their wives have flown with us in all parts of America. They tell us they would rather fly with us because we do not stunt.

We think we are on the right road and I, as a pilot, know that I am as I want to prove to the world that air travel is absolutely the safest of any yet devised by man and it really is when conservative men are at the stick. I never buck storms or fly anywhere any time unless I can glide to safety. I never try to run a man off his car on the highway or dive at a city. I fly high and straight and I believe I will be flying that way 40 years from now, as I know I'm not giving up aviation as long as I have one good arm.

Let's have Federal control and do away with daring stunts and advance aviation by injecting confidence into the minds of the public instead of fear.

I can do any stunt known but I feel as though it will get you somehow some day, so I'll continue to fly straight. Let's all get on the sane side and let stunt flying alone.



The Sunbeam-Coatalen "Cossack" Aircraft 350 H.P. Engine. This type of power plant is used on the ZR2

The AIRCRAFT TRADE REVIEW

Curtiss Heads Movie Studio Company

Announcement has been made of the organization of a new motion picture community enterprise, to be known as the Miami Studios, Inc., located at Hialeah, on the outskirts of Miami, Fla. Glenn H. Curtiss, one of the dominant figures in American aviation, is president; John W. Claussen, director of the First National Bank of Miami, vice-president; E. G. Sewell, member of the firm of Sewell Bros., Miami, secretary and treasurer. Other directors are E. R. Brackett and J. H. Bright of Miami.

These new studios, which are expected to be ready for occupancy Dec. 1st, are located on a 140-acre lot on the Miami Canal, about five miles from the centre of Miami. They will consist of a community group of unit studios, fully equipped for production, each with a stage 125 ft. long, 60 ft. wide, with a working height of 24 ft., provided with a trap 16 ft. square and 8 ft. deep.

It is the plan to furnish producers with complete individual plants. Carpenter, electrical and property making shops, a large warehouse, laboratories, and a complete power plant. When completed these studios will accommodate from two to sixteen companies at one time, and may be leased by the week, month or year.

Curtiss-Herring Suit

Rochester.—An action which the plaintiff states involves $50,000,000 was brought before Justice S. Nelson Sawyer in Special Term of Supreme Court here July 6 against Glenn H. Curtiss by Augustus Herring, a former partner. Herring seeks an accounting of the Herring-Curtiss Company since 1908, when the firm went bankrupt. The company, which is located at Hammondsport, was purchased by Curtiss following bankruptcy proceedings.

Curtiss denies all material allegations in his answer. He was in court when the case was called. Thomas J. Baldwin, expert balloonist for the government and other aviation experts were also present as witnesses.

McSpaden With Fairchild

Lt. McSpaden, 24 Squadron, Frst Army Observation Group, has recently been retained by the Fairchild Aerial Camera Corporation.

Lt. McSpaden graduated from the University of California and is one of the most experienced aerial photographic pilots in the United States Air Service. He did extensive work in France and has actually flown and surveyed while at work with Captain Stevens and other officers of the Photographic Section, 1,000 square miles of territory in the United States. The 300-square-mile mosaic of Camp Benning was not only flown but assembled and brought to scale by his earnest and patient efforts to prove the practicability and accuracy of the aerial survey.

At McCook Field, Dayton, Ohio, he flew and personally assisted in a series of tests to determine the most efficient and satisfactory aerial equipment to be adopted by the United States Air Service.

The mosaic of Washington, photographed in 1919, was one of the first attempts to completely photograph a city, and its success was due to the efforts of Captain Stevens and Lt. McSpaden.

Lt. McSpaden has experienced his approval of the Fairchild equipment designed to put the aerial survey on an economic commercial basis. He is now conducting a series of tests which will add to man's domain many new and interesting results to be obtained by the aerial camera.

Lt. McSpaden is that conservative that he objects to calling the assembly of aerial photographs anything but a mosaic.

He states, however, the survey and precision map will soon be forthcoming.

Wright Motor Stands 415 Hours Test

Flight "A", Carlstrom Field, boasts of a Wright Motor with 415 hours and 50 minutes to its credit. It has been used exclusively by solo students during the entire life in the plane. This is a remarkable record for flying time on a motor without overhauling. Flight "B" at this station, some time ago had a motor to go 407 hours before it was ordered taken down by the Engineering Department for inspection. The pilots and mechanics at this station have been handling their motors to perfection, according to above records.

Canadian Air Board Estimates Passed

The estimate of the Air Board for $700,000 for civilian aviation was passed by the House of Commons recently. Hon. Hugh Guthrie, in charge of the estimates, explained that Canada was to have the advantage. Flying men were now used to stop the smuggling of drugs into Canada. The habit had been for smugglers on large ships to throw the drugs overboard when many miles from harbor. Smaller craft had picked up the buoyed packages and landed them in obscure ports, from which the contents were transported by hidden routes to the large cities. Aircraft, in experiments conducted by the Government, had proved an effective means of combating such traffic. He also referred to the Dominion Land Surveys, in which the aeroplanes had played a valuable part.

However, after a question by Mr. Lemieux, the Minister said that aeroplanes were impossible on account of the prohibitive cost, in the matters of commercial enterprise, at the present time. Mr. Lemieux asked about the London-Paris service. Mr. Guthrie replied that it was not a commercial success. There was a theory, he continued, that an air service never could be a success. Mr. Lemieux replied that the word "never" was not in the dictionary of the successful. A. R. McMaster (Brome) argued that expenditure, except for a matter of experiment, was against economy, and that such a large expenditure should not be made.

System of Airways Urged

Washington.—A system of model airways, covering the entire continent, is planned by the Army Air Service for the use of all operators or owners of aircraft. It contemplates chains of well organized landing fields, supplemented by frequent emergency fields and identification markers connecting the principal cities.

Because of the lask of appropriations from the Federal Government, air service officials said it was their purpose to appeal to the chambers of commerce, aerial clubs and civic organizations to assist in creation of the airways.

The Boy Scouts organization already has pledged its cooperation, it was stated, and will construct identification markers, guard wrecked planes, submit monthly reports on emergency landing field conditions and generally assist aviators in trouble.

The plan calls for the first of the model airways between Washington and Dayton, Ohio, with five main stations, ten subsidiary stations and twenty emergency fields. These will be divided among Leesburg, Va.; Charles Town, Pawpaw, Moundsville and Morgantown, W. Va.; Cumberland, Frostburg and Oakland, Md.; Point Marion, Smithfield and Waynesburg, Pa.; Pleasant City, Cambridge, Zanesville, Columbus, Springfield and Dayton, Ohio.

Each main station will be provided with a municipal landing field, wireless and telephone equipment and a meteorological station which will forecast weather conditions and wind directions and disseminate such information to the fliers along the route.

Other routes tentatively approved by the air service to be included in the national system of air trails include one from New York city to Langley Field, Virginia, connecting the principal cities between the two terminals; one from Jacksonville, Fla., to San Diego, Cal., along a general line of Mobile, Ala.; San Antonio, Tex., and Tucson, Ariz.; another from St. Paul and Minneapolis to Seattle, to be known as the Yellowstone trail, along the general line of Aberdeen, S. D.; Miles City, Billings and Butte, Mont.; Coeur d'Alene, Idaho, and Spokane, Wash., and another proposes to connect New Orleans, La., and Chicago, Ill., taking the Mississippi Valley route.

312 Miles an Hour Claimed for Helicopter

The Hague.—Dutch agents here are exploiting a new helicopter invented by a German named Hanschk which, it is predicted, will revolutionize aviation.

The helicopter makes 500 kilometers (312½ miles) an hour, can ascend and descend vertically, remain stationary in the air and cannot fall, it is claimed.

Hanschk declares he could fly to New York in one day, and is convinced that, if financed, he could win the $1,000,000 prize for a flight around the world.

Colonel Williams, chief of the British aviation Commission, who saw a model in Berlin, considered it a most wonderful invention and expressed amazement.

Allied restrictions prevent Hanschk from constructing his invention in Germany now, but during the war the German War Ministry forbade Hanschk to offer it to any foreign country, although unable to use it as the adoption of the helicopter would have meant reorganization of the flying corps.

SIMPLE MEANS FOR SAVING FUEL ON TRAFFIC FLIGHTS

By E. KOOK

(Technical Note from the National Advisory Committee for Aeronautics)

MANY of the war areoplanes are not suitable for traffic, because they have been one-sidedly developed for definite war purposes (climbing, for example, and flying at high altitudes) and are incapable of rendering traffic service with economy of fuel. The latter qualification was considered important only for aircraft, like seaplanes, requiring a large radius of action.

The following experiments are intended to show how exisiting aeroplanes, built for war purposes, can, by simple means. reduce their fuel consumption and thus become better adapted for traffic purposes. The experiments described were performed at the seaplane experiment station at Warnemünde, and, with the exception of some of those described in Section I, were conducted by the author.

1. Flying with Throttled Engine

By flying with throttled engine and at less than the maximum flying speed, the fuel consumption is greatly reduced in proportion to the distance flown. Regarding the amount of this reduction, no exact data have thus far been available. Most aviators are even ignorant of the fact itself. They nearly always fly with a small degree of throttling, but only to spare the engine. The maximum utilization of this simplest means of saving fuel is desirable, in spite of the consequent speed reduction, for many traffic aeroplanes, in the event of a head wind, for example, and on long trips to distant regions without rapid railroad communication.

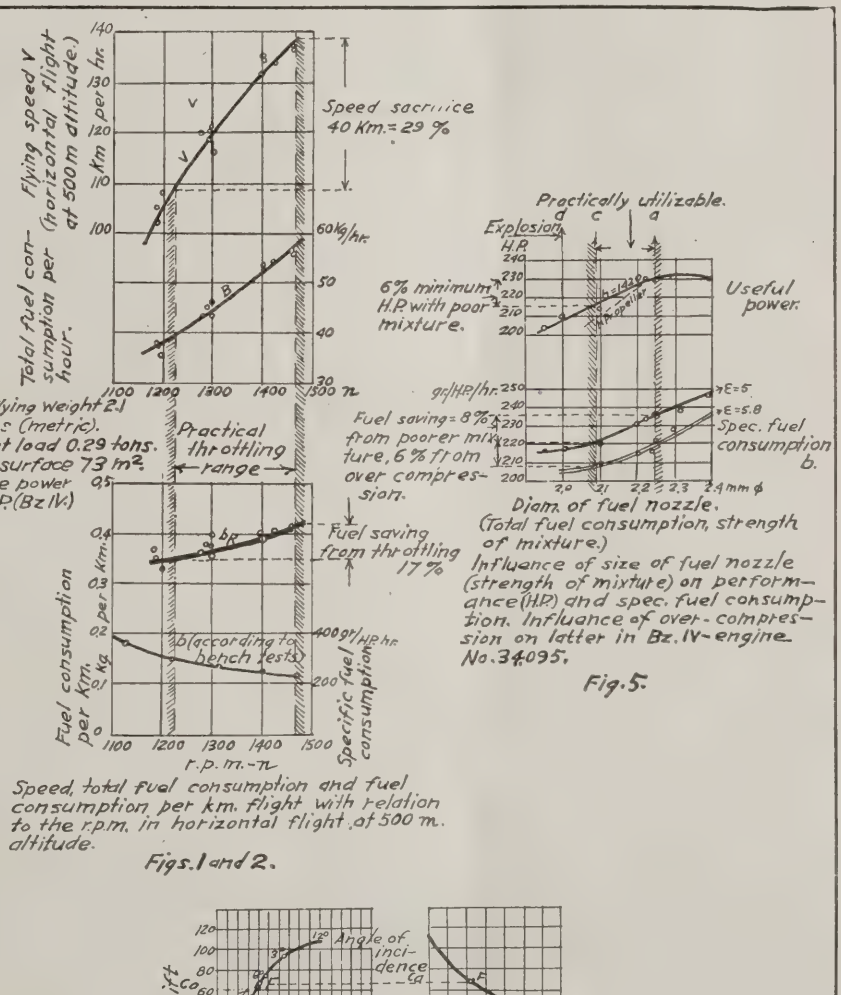
Fig. 1 shows, with relation to the changed engine speed (r.p.m.) n, the flying speed V (with relation to the air) and the hourly fuel consumption B of a seaplane, which were measured by suitable methods, during careful horizontal flight at 500 meters altitude. $\frac{B}{V}$ gives the fuel consumption, b_R, of this aeroplane for one kilometer is still air (Fig. 2); b_r divided by the total weight or by the useful load (available carrying capacity) gives the fuel consumption respectively per total or per useful ton-kilometer.

According to the experiments, the value of b_R drops from the highest r.p.m. and flying speed rapidly at first (so that even slight throttling results in a comparatively large fuel saving with only a moderate sacrifice in speed) down to the r.p.m. and flying speed at which horizontal flight is only just possible and below which any further reduction would cause the aeroplane to fall. For the aeroplane tested, this was when n had dropped to about 1100 r.p.m. and V to 90 km. per hour. The throttling should, however, for the sake of safety and ease in steering, never be carried to this limit, but only to a certain higher speed. (In this instance n = 1200, V = 110 km. per hour.) At the lower limit of this "practical" throttling (with about 20% lower flying speed), the fuel consumption per kilometer of flight is 17% less than with wide open throttle and maximum flying speed. Similar results were also obtained with other aeroplanes.

For economy of engine power alone, throttling is disadvantageous, since the specific consumption b_e per work unit increases with the decreasing revolution speed, on account of the accompanying decrease in load (in about the third power), as shown approximately by Fig. 2 (according to bench tests). The propeller efficiency suffers no substantial change from the throttling, since (according to Fig. 1) the revolution speed and flying speed are nearly proportional. The favorable result can hence be attributed only to the characteristics of the particular aeroplane and must be due to the fact that its head resistance diminishes with its speed. If the head resistance remained constant, the engine efficiency would diminish only in proportion to the speed, while the propeller thrust and the energy consumed per kilometer would remain the same, as likewise the fuel consumption. As a matter of fact, the fuel consumption (b_R) per km. diminishes with the diminishing speed (Fig. 2) and, at the same time, the head resistance W must diminish still more, on account of the diminishing efficiency of the transformation of the fuel into mechanical energy.

This result is in accordance with the fundamental principles of aerodynamics. With throttling and diminished speed, the air resistance would become less, but also the lift A, in proportion to the square of the latter, and horizontal flight would be no longer possible, unless, at the same time, the aeroplane were given a greater incidence, so that the lift would remain the same. Hereby W is further increased, without its attaining, however, like A, the same value as with unthrottled speed. The gliding angle ($\phi = \frac{W}{A}$) also becomes more favorable.

According to experimets with models, every supporting surface and also every



Speed, total fuel consumption and fuel consumption per km. flight with relation to the r.p.m. in horizontal flight, at 500 m. altitude.

Figs. 1 and 2.

(Total fuel consumption, strength of mixture.) Influence of size of fuel nozzle (strength of mixture) on performance (H.P.) and spec. fuel consumption. Influence of over-compression on latter in Bz. IV-engine No. 34095.

Fig. 5.

Figs. 3 and 4.

(Footnote to Fig. 4.) Lift curve of a biplane model according to Munk and Molthon. Bulletin No. 20 of the Göttingen Model-testing Institute for Aerodynamics (Mitteilung 20 der Göttingen Modellversuchsanstalt für Aerodynamik).

aeroplane has a most favorable incidence f (Fig. 3), for which the lift can be obtained with the least resistance. Thus $\frac{W}{A}$ and the angle Φ in Fig. 3 have a minimum value. Any other angle of incidence is less favorable.

Fig. 3 shows the lift curve in the known representation with the indefinite lift number c_a, with which

$$A = c_a \times \frac{v^2}{2} \times F \times \frac{\gamma}{g}$$

(v is given here in m. per sec.). With diminishing c_a the speed must increase according to its square, so as to keep the lift constant (Fig. 4).

The most advantageous utilization of power and fuel would now be obtained, if this most favorable angle of incidence for the normal speed were made the basis for the maximum speed of traffic aeroplanes. This is impossible, however, for the reason that then, with lower speeds, the drag and propeller thrust would have to be increased for the same lift, according to Fig. 3; slow horizontal flight with throttled engine would be altogether impossible on account of the consequent decrease in the moment of torsion and propeller thrust; there would also be no reserve power for starting and climbing; and, furthermore, for readily understood reasons, the least loss of speed (with f) would be disastrous for landing. In building aeroplanes, a smaller, less favorable angle of incidence must therefore be adopted, in order that the most favorable angles of incidence (with diminished speed) may be reserved for landing and climbing. This relation is the principal source of fuel saving per kilometer, through throttling.

For climbing and landing, hence also for angles of incidence near f, only limited speeds are practicable, which can not be much higher for swift aeroplanes than for slow ones. The greater, therefore, the maximum speed of an aeroplane is, just so much less favorable angles of incidence must be employed in the lower part of the curve in Fig. 3. For this reason, a greater throttle range and consequent fuel saving can be attained with swift aeroplanes than with slow ones, though with a greater sacrifice of speed.

II. Carburetor Adjustment for Most Economical Fuel Consumption

Most of the present aeroplane engines are adjusted more with reference to their greatest possible output, than for economy in fuel consumption. This was demonstrated by the experiments (Fig. 5) in which only the size of the fuel nozzles was changed, while the engine speed (r.p.m.) and throttle remained the same and the air intake nearly so. The total fuel consumption and the richness of the carburetor mixture increases with the size of the nozzles. The highest engine efficiency is obtained in the vicinity of nozzle a, with a certain minimum intake of fuel, and the engine was adjusted on this basis at the factory. A larger intake than this does not further increase the efficiency, since the intake of air is insufficient for the combustion of a larger amount of fuel. Consequently the excess of fuel is wasted, as shown by the rapidly rising specific consumption b per H.P. By still further increasing the size of the nozzle and the fuel intake, the maximum efficiency is again reduced, for reasons not to be discussed here. A greater fuel intake than provided for by nozzle a never comes, therefore, into practical consideration.

On the contrary, smaller nozzles than a give a considerably higher efficiency. The total fuel consumption diminishes, the quantity of air is unchanged and the mixture is correspondingly poorer. Down to a certain limit, the engine efficiency is hereby increased, simply because the chemical combustion is more complete. The fuel consumption per H.P., therefore, falls. The maximum output can, however, no longer be obtained, since, on account of the smaller total intake of fuel, less is now burnt, notwithstanding the sufficient supply of air. The output does not, however, drop so much on this account as the fuel intake, since, as already mentioned, the practical efficiency is now improved. The minimum specific fuel consumption is reached with nozzle d. The reduction in the size of the nozzles must, nevertheless, not be carried so far in practice, since most aviation engines then have a tendency to backfire, as sometimes also when the engine is cold, and in cold damp weather. This results from the intake of new gas into the cylinder while the residue of the previous charge is still burning, on account of the slow combustion rate of the poor mixture. A certain safety margin must be maintained with reference to this backfiring limit, so that smaller nozzles than c are not practicable.*

The war aeroplane engines are now mostly adjusted for mixtures capable of giving the greatest output in energy and with fuel nozzles in the vicinity of a. A fuel saving, up to 8%, is attainable by readjusting them at c. The consequent output sacrifice is 9%, on account of the simultaneous decrease in the revolution speed of the propeller, which may, however, be reduced to only 6% by employing a new propeller with the former revolution speed. With supercompressed engines, it is possible, and usually allowable, to avoid this entirely, by a corresponding increase in gas intake.

This readjustment for a poorer fuel mixture results in a greater heating of the engine, especially of the exhaust valves, on account of the slower combustion. For most engines, however, a and c are allowable limits.

This readjustment may be made without removing the engine from the aeroplane. Consumption increases are not necessary in this connection. The object may be attained, by successively trying smaller nozzles (with a cold engine), down to the backfiring limit, and then adopting, for ultimate use, a nozzle somewhat larger than the one found to be the limit, for the sake of the above mentioned safety.

The behavior of over-compressed engines is fundamentally the same (Fig. 4). The adjustment must be made with the engine throttled for normal sea-level horsepower.

Aviation engines correctly regulated for gasoline are in all cases nearly correct for benzol, as demonstrated by many experiments.

According to the above, there is a goal for progress in the possibility of employing poorer mixtures without danger of backfiring. We can not now go into the methods for accomplishing this. Furthermore, according to comparative tests, most carburetors are capable of improvement with respect to the thorough mixing of air and fuel, which is essential for minimum fuel consumption.

III. Over-compression

Most present-day engines, at least nearly all of those built since 1917, employ more or less over-compression, for lessening the falling off of engine power with increasing altitude. Only because in this connection, on account of the small heat evolution, the temperature of the walls of the combustion chamber (as well as that of the surrounding air) is lower, can the compression ratio be increased, without danger of pre-ignition. The higher compression ratio causes a diminution of fuel consumption and an increase of the average pressure, though the latter can be fully utilized only above a certain altitude. On the ground and at the low altitudes for air traffic, such an engine must be so strongly throttled, that the heating of the walls from the high compression remains correspondingly low.

With moderate over-compression ($\epsilon \backsim 5.8$), it is usually sufficient to throttle down to the same sea-level horsepower obtained under normal compression $\epsilon \backsim 5$ with throttle wide open. Stronger over-compression requires further throttling to a smaller sea-level horsepower. This is a disadvantage for air traffic at low altitudes, because the unit weight is thereby increased, even when the engine is over-dimensioned to correspond to the smaller maximum pressure resulting from the smaller middle pressure. In contrast with the increased horsepower and in spite of the throttling, there is still the advantage of smaller specific fuel consumption, even at sea-level. According to Fig. 4, there is a fuel saving of 6% with an over-compression of $\epsilon = 5.8$, as compared with the normal compression of $\epsilon = 5$. Consequently, even for air traffic engines, the retention of original application (through taller cylinders) of over-compression comes under consideration, but only to a certain limit not much higher than the above-mentioned value, which cannot here be more definitely determined. Not all engines can stand over-compression, or at least not equally well. In types with insufficient cooling of the hottest parts of the walls of the combustion space, spark plugs, exhaust valves and cylinder bottoms, the permissible normal compression for complete charging at sea-level can only be small and, for this very reason it is, with this type of engines, often raised to the limit where spontaneous combustion occurs. In such a case, even a slight over-compression is only made possible by such strong throttling that its practical application is out of the question.

The benzol fuels, which are of preponderant importance for air traffic, are less sensitive in this way, since they can stand a higher compression than gasoline, on account of their higher kindling temperature and slower combustion rate.

According to war experience, no disadvantage arose from moderate over-compression and there is likewise none to be feared in air traffic. For avoiding excessive stresses, care must be taken to render even the temporary delivery of "altitude gas" above sea-level horsepower impossible.

Engines with strong over-compression are somewhat sensitive only to a sudden stopping when heated from running under full load. With the last revolutions there then occur, in spite of the switching off of the electric ignition, violent self-ignitions which cause back strokes of the engine with strong stresses. This is, however, prevented when the stop is made gradually, as it should be for any aviation engine, after it has run empty for several minutes and become partially cooled.

IV. Choice of a Suitable Propellor for Horizontal Flight

Many war aeroplanes have propellers with more or less one-sided climbing ability. These work at a disadvantage in

---

* The minimum fuel consumption occurs in a mixture containing 1.2 times, and the maximum output (corresponding to nozzle a) about 0.8 of the chemically required air quantity—according to Strombeck, Experiments with Automobile Engines (Untersuchungen an Automobilmotoren), 'Oelmotor" 1913-14, and Neumann, Researches (Forschungsarbeiten) No. 79.

horizontal flight and thereby increase the fuel consumption.

In climbing, the flying speed is much slower than in horizontal flight and the revolution speed of the propeller is likewise less. For obtaining the greatest climbing efficiency, propellers were employed which, even with the low climbing speed, had almost the maximum allowable revolution speed and climbed with a good degree of efficiency. In horizontal flight, these propellers worked with an unfavorably high revolution speed, both for the engine drive and for propeller efficiency. A greater flying speed and a more efficient utilization of the fuel is obtained with propellers which, in horizontal flight, have only the maximum allowable revolution speed (about 1400 r.p.m. for fixed engines) with good efficiency. Only such propellers are suitable for air traffic.

Summary

By flying with throttled engine and diminished speed, without reference to the wind, the fuel consumption is lessened and all the more with stronger throttling. In experiments on aeroplanes with a low maximum speed, throttling within practical flying limits resulted in a fuel saving of 17%.

Over-compression should be employed on air traffic engines, for the sake of the fuel economy thereby attainable.

The carburetors of most engines can be adjusted so as to save fuel, with only a slight sacrifice in power.

Speed propellers are the most economical for air traffic aeroplanes.

ABSOLUTE COEFFICIENTS AND THE GRAPHICAL REPRESENTATION OF AEROFOIL CHARACTERISTICS

(Technical Note of the National Advisory Committee for Aeronautics)

Introduction

It is customary to examine the aerodynamic qualities of an aerofoil by considering the coefficients of the forces, rather than the actual forces, corresponding to any particular set of conditions. Such a coefficient, being always non-dimensional (absolute), is the ratio of the actual force to some standard force corresponding to the given area, relative velocity, and air density. It is only by the use of such coefficients that the designer is able to judge the qualities of a profile and to compare, on the same basis, one profile with another. The reports of tests whether on models or in free-flight usually include both the observed forces and the calculated coefficients, although it is not uncommon to find in published reports only the coefficients. The angles of attack are always given to make these data complete.

The use of absolute coefficients is almost universal in all sciences in all countries, which shows their advantage. Unfortunately in the science of aeronautics there is some lack of agreement as to conventions and there are not only several kinds of coefficients in use in various countries but there are also differences in the methods used in plotting them. In some countries there have been changes even in the standard both for the coefficients and for the methods of plotting. As a result, the older publications using obsolete methods are confusing to the average reader who is, perhaps, familiar with the current methods only. The fact that such changes have been made is sufficient proof that there are certain advantages or disadvantages connected with each scheme in use, since it is hardly likely that an entire country would change from one system to another if all were of equal merit. Indeed, it may be shown that the lift and drag of an aerofoil supply an example of those quantities which require the use of a certain absolute coefficient and a particular method of graphical representation, in order that the results may be interpreted fully.

Coefficients

In aeronautics there are two types of absolute coefficients which demand particular attention. The first kind is in common use in the United States and England, the second kind in Germany. The essential difference lies in the "standard force," which is only half as great in the second kind as in the first. That is, the absolute coefficients of lift and drag are determined in the United States by the expression:

$$F = C \frac{\rho}{g} S V^2 \quad \text{.............. (1)}$$

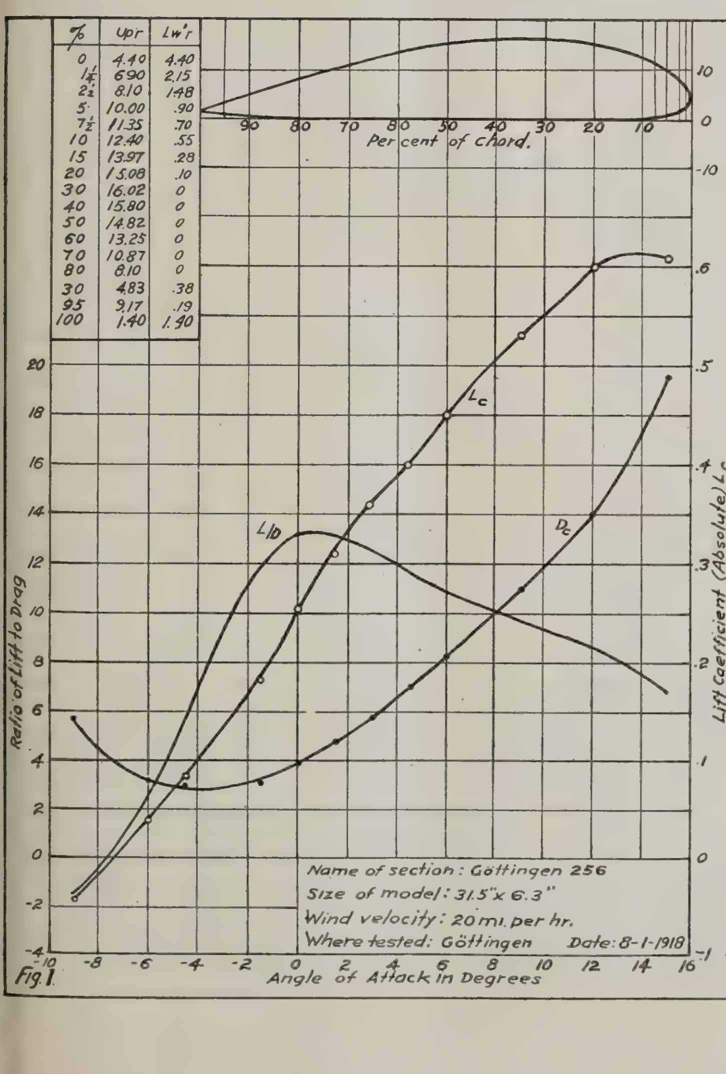


Fig. 1.

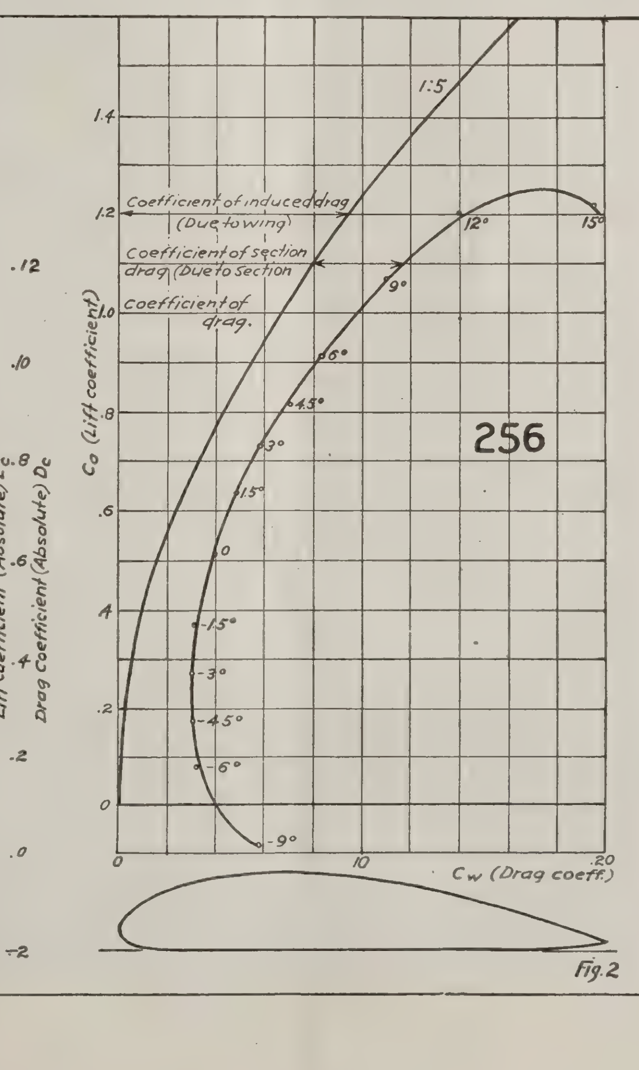


Fig. 2

where

F is the force

$\frac{\rho}{g}$ the mass-density of the air

S the area of the aerofoil

V the relative velocity

C the absolute coefficient of the force F.

While the absolute coefficients of lift and drag are determined in Germany by the expression:

$$F = C \frac{\rho}{2g} S V^2 \quad \ldots\ldots\ldots\ldots\ldots \quad (2)$$

It appears upon casual examination that the system in use in the United States is the more natural and therefore the better on account of the omission of the coefficient 1/2. Upon a careful study, however, it is evident that the second system is superior to the first in two respects. Since both sides of equations (1) and (2) represent a force, the expressions $\frac{\rho}{g} V^2$ and $\frac{\rho}{2g} V^2$ must represent a force per unit area, that is, a pressure, and it is of especial importance to understand clearly the exact pressure to which each refers. Otherwise it is not likely that the exact significance of the absolute coefficients will be understood. The second expression, $\frac{1}{2}\frac{\rho}{g} V^2$, is the difference between the maximum pressure on the surface of a body due to air having a velocity V and the pressure in air at rest. This pressure difference is that given by the common Pitot-tube and may be called the "Dynamical Pressure." In the German publications it is denoted by the symbol q. On the other hand the first expression $\frac{\rho}{g} V^2$ has no physical meaning and can only be understood and felt as "Twice the Dynamical Pressure." The two expressions are closely related to the expression for the kinetic energy of a moving body, $1/2\, MV^2$. The coefficient 1/2 resulting from the integration of VdV cannot be avoided here. The expression MV^2 is never considered.

In forming absolute coefficients the choice of the natural expression $\frac{1}{2}\frac{\rho}{g} V^2$ instead of the meaningless expression $\frac{\rho}{g} V^2$ as the standard pressure, not only gives the coefficient a definite physical meaning, but also renders the quantities easily understood by enabling the density and the square of the velocity to be always grouped together and considered as the dynamical pressure.

There are additional advantages connected with the use of the natural absolute coefficients based on the expression $\frac{1}{2}\frac{\rho}{g} V^2$. The advantages are apparent when it is necessary to make use of certain theorems connecting lift, drag and angle of attack (see Technische Berlchte II-2). These theorems and the formulæ resulting from them are not only interesting from a physical point of view but are also of great practical value to the designer of aircraft. Furthermore, these formulæ are quite simple and it requires no more mathematical knowledge and calculation to understand and to apply them than it requires to apply the simplest formulæ for the stresses in bent beams. These formulæ demand the use of the natural absolute coefficients based on the actual dynamical pressure if the simple form is to be retained. The use of the absolute coefficients which are now standard in the United States and England, introduces additional factors confusing and likely to lead to error in substitution.

Graphical Representation

There are two principal methods of representing graphically the characteristics of an aerofoil. In the United States and England it is customary to plot lift and drag coefficients as ordinates against angles of attack as abscissæ, thus obtaining two curves. The continental method, sometimes called the "polar diagram,"* employs but a single curve in which the lift coefficients are plotted as ordinates and the drag coefficients as abscissæ. The angles of attack are commonly indicated on this diagram by figures alongside of the curve.

The results of a test on a model wing are plotted in Fig. 1, according to the usual American and British practice, and in Fig. 2, the same data are plotted according to Continental usage. These methods differ greatly and the true points of difference are not always well understood. In the first place the angle of attack has no definite significance aerodynamically, for it is merely an agreement or convention which considers the chord as the direction of the section. Further, the definition of "chord" is not clear in all cases. It fails entirely when a wing is twisted (wash-in or wash-out) or when the chords of a system of two or more wings are not parallel. Consequently, in plotting coefficients against angle of attack there is obtained no natural comparison between the characteristics of various aerofoils. The position of the Y-axis has no special physical meaning and is unimportant for the qualities of the aerofoil. Hence by using this method the designer renounces one of the advantages—and the simplest too—which are connected with plotting at all.

The designer usually desires a large lift and a small drag. These two quantities and their relation to each other are most important in making an estimate of the value of an aerofoil. The angle of attack is merely a structural consideration. In order to obtain a connection between the lift and drag when separate curves are plotted against angle of attack, it is necessary to carry through tedious mental processes and the final result can not compare in vividness with the mental picture given by a glance at a polar diagram.

There are also reasons why the polar diagram is the "natural" method of representing aerofoil characteristics graphically. Aerodynamical theorems and actual tests prove that the lift depends not upon the angle of attack but upon the flow about the wing. That is to say, the air flow around wings of the same sections but of different plan form is the same for equal lift coefficients and not necessarily for equal angles of attack. Furthermore, the drag may be divided into two parts, one of which depends upon the lift but neither of which depends upon the angle of attack. One of the formulæ previously mentioned (Technische Berichte II-2) provides a very simple method by which one may calculate that part of the drag which is due only to the particular arrangement and proportions of the lifting surfaces. This part of the drag is independent of the aerofoil section and is called the "induced drag." The induced drag may be considered as the minimum limit of drag consistent with the aspect ratio used and is an ideal which may be approached through the reduction of "section drag" but which can never be equaled. This "section drag" is conditioned by the aerofoil section and must be obtained from tests either on models or in free flight. This part of the drag is determined for example, by the change in the performance of an aeroplane when only the total load is changed. The first and sometimes the more important part of the drag may be calculated very quickly with a slide rule, and without the necessity of tests, may be plotted as a parabola, dependent upon the lift. The formula for this "induced" drag is:

$$D = \frac{1}{\pi}\,\frac{L^2}{V^2 \frac{\rho}{2}}\,\frac{1}{B^2} \quad \ldots\ldots\ldots\ldots\ldots \quad (1)$$

where L is the lift; B the span; and $V^2 \rho/2$ the dynamical pressure. Written in absolute coefficients, defined by

$$D = D_c \frac{\rho}{2} V^2 S, \text{ etc.}$$

where S is the area, the same formula becomes:

$$D_c = \frac{1}{\pi} L_c^2 \frac{S}{B^2} \quad \ldots\ldots\ldots\ldots \quad (1a)$$

This formula holds for single aerofoils; and for systems of aerofoils, B is to be replaced by kB where k is a coefficient somewhat different from 1. This formula represents a parabola which, however, cannot be plotted dependent upon the angle of attack, without tests, because there is no definite relation between the lift and the angle of attack. The designer who uses the plots of lift and drag against angle of attack instead of the polar diagram gives up half of the advantages to be obtained from the use of the formulæ.

Regardless of the attitude of the designer towards the method which he uses to plot aerofoil characteristics, it is certain that his conclusions are influenced by these diagrams, and that an unfavorable or obscure diagram may lead to a wrong conclusion. The curves of lift plotted against angle certainly do this very often. For instance, a designer may be led to compare two different wings, or even two different sections, at the same angle of attack instead of at the same lift or drag coefficient. An ingenious man usually draws correct conclusions; but it is an advantage to use diagrams which may be also interpreted by men who are not specialists in aerodynamics.

Other Possibilities of Graphical Representation

The principal difference between the two kinds of plotting mentioned is the change of the variables. There are special advantages connected with the plotting of the lift and drag coefficients directly against each other. Now these advantages would not vanish if, instead of plotting the coefficients themselves, functions of them were taken. It is worth while to compare the advantages of several such diagrams.

Any two such diagrams are mathematically connected with each other. Any construction in the one diagram can be repeated in the other, and to each curve drawn in the one belongs a corresponding curve in the other. In general, the corresponding curve is not a straight line if the original curve is a straight line. The chief difference between different diagrams lies in the type of curve by which the most important relations are represented.

* If lift and drag are plotted in the same scale, the line of connection between any point of the curve and the origin of the system of cordinates is the vector of the force on the wing as to direction and size. Therefore, this diagram can be considered to be a polar diagram, the radii representing the absolute magnitude of the forces and the angle representing the angle between the force and the direction of motion.

In the diagram generally used, L_c against D_c, the curves of constant L_c and D_c of constant L/D, and of constant velocity are straight, and the "induced" coefficient curve and the important curves for constant power $\frac{D_c}{L_c^{3/2}}$ = const. are curved lines. If one coordinate is the drag coefficient itself, the addition of a constant drag coefficient, for instance, when proceeding from the wings to the entire aeroplane, can be represented by merely transferring the origin of the system of coordinates. The original curve remains unaltered. This quality of the diagram is so useful that a diagram without it would be inferior. Whence it follows that D_c should always be plotted directly in one direction. To so choose coordinates that the curves for constant L/D are straight is in a smaller degree advantageous. It is true that L/D is frequently considered in present practice, but this is done, not because it means very much, but because in the present diagrams this quantity is the only one giving a direct relation between L_c and D_c. It would be better if the curves for constant power are straight, for the power is more important than the angle of gliding. This can be obtained by plotting $L_c^{3/2}$ instead of L_c against D_c. The induced coefficient remains a curved line, and all advantages of the first diagram remain too. It is not even necessary to calculate and to put in the values of the 1.5 power of L_c; for, as in logarithmic diagrams, it is quite sufficient to use a proper variable graduation of the corresponding axis of coordinates.

Another possibility would be the plotting of $D_c^{3/2}/L_c$ against D_c. The power would be plotted as it were against the drag, whereas in the preceding diagram it can be considered as being plotted against the lift. This seems to be more natural.

L/D against L_c sometimes used in England, gives straight lines for constant D_c; but the addition of a constant D_c requires a new curve; nor are the curves for the induced coefficient or for constant power nor for L_c straight. The drawing of a new curve when adding a constant D_c is still more complicated than before.

There remains therefore only the diagram $L_c^{3/2}$ against D_c as a competitor to the diagram L_c against D_c. The differences between the two diagrams are not considerable. It is convenient to have straight lines for constant power but the odd power of L_c is sometimes confusing. In any case the advantages are not sufficient to compensate for the disadvantage of using diagrams differing from those used in most other countries.

Conclusions

In addition to the important features connected with the use of natural absolute coefficients in polar diagrams there are several minor advantages. A few of the special applications are given in the above references. On the whole it appears that the use of natural absolute coefficients in a polar diagram is the logical method for presentation of aerofoil characteristics. Serious consideration should be given to the advisability of adopting this method in all countries. The actual adoption would be a great advancement of uniformity and accuracy in the science of aeronautics.

BRITISH GOVERNMENTAL CO-OPERATION IN COMMERCIAL AERONAUTICS

THE British Air Ministry has just issued the details of its plan for cooperation with the companies operating passenger and freight services across the channel. These proposals for developing Cross-Channel aeroplane services emanated from the committee appointed by the Secretary of State for Air, to make recommendations for ensuring the maintenance of air transport on Cross-Channel routes. They have been adopted by the Air Council and have received the approval of the Lords Commissioners of the Treasury.

Lord Londonderry. Under-Secretary of State for Air. was Chairman of this Com mittee. with Sir Frederick Sykes. G.B.E., K.C.B., C.M.G., Controller-General of Civil Aviation, and Sir James Stevenson, Bart., Members, and Mr. F. G. L. Bert ram, C.B.E., Secretary.

The intention of the Air Council is that there may be no break in the services on the London-Paris routes being operated by Messrs. Handley Page, Ltd., and Messrs. S. Instone and Co., Ltd., under the present temporary scheme, and the operation of services on the route by "approved" firms under the new scheme.

Following is the plan decided on:

The Air Ministry announces that it is now empowered to put into operation the recommendations of Lord Londonderry's Committee on Cross-Channel Aeroplane Services, which are that:

(a) Firms should be "approved" by the Air Ministry on certain conditions for the operation of agreed cross-channel routes.

(b) Orders should be placed by the Air Ministry for aeroplanes of modern commercial types to be hired out to "approved" firms.

(c) A subsidy of 25% should be paid by the Air Ministry on an "approved" firm's gross earnings.

Applications are now invited from those who wish to be recognized as "approved" firms by the Air Ministry and to participate in the scheme described below.

With the approval of the Lords Commissioners of H. M. Treasury, a sum of approximately £200,000 per annum will be set aside from Civil Aviation votes for three years. This sum of £600,000 (including expenditure on the temporary scheme, now in operation which will not exceed £50,000) will be used for the following purposes:

(a) The Air Ministry will order a limited number of machines for transport purposes, embodying the latest improvements suggested by experience. These machines will be let out on hire to "approved" firms to augment their fleets.

(b) The Air Ministry will grant subsidies during the same period of three years on the basis of 25% on an "approved" firm's gross earnings operating on any of the following routes:

London-Paris,
London-Brussels,
London-Amsterdam,

(Further routes may be approved at a later date.)

under the conditions referred to below, with the proviso that when in any financial year of the firm concerned the net profits (inclusive of subsidies) arrived at after full allowance for depreciation and any other charges agreed to by the Air Ministry would permit a payment of over 15% of the total subscribed cash capital to be employed on these services, the balance in excess of the 15% shall be refunded to the Air Ministry up to the limit of the amount received as subsidy.

The Air Council propose that the following regulations should govern the hiring out of machines:

(1) The number of machines to be ordered by the Air Ministry will be limited by the amount of money available.

(2) The specifications of the machines to be ordered by the Air Ministry will be drawn up after consultation with representatives of the firms approved.

(3) The machines after completion and after having passed the preliminary trials satisfactorily will be available for hire under the conditions stated below.

(4) Firms operating these machines will be required to ensure them, in the name of the Secretary of State for Air at a value to be stated in each case by the Air Ministry, against loss or damage by accident resulting from operation in addition to normal insurance against fire, etc., and to maintain them in an airworthy condition subject to fair wear and tear.

(5) (a) Firms operating will be required to pay the Air Ministry a monthly rental equivalent to 2½% of the cost of the machine.

(b) After 30 such payments have been made the machines will become the property of the firms.

The conditions under which firms may be accepted by the Air Ministry as "approved" are as follows:

(I) *(a) *Personal.*—The companies, directors, shareholders, pilots, members of the crews, and the mechanics employed in England must be of British nationality.

*(b) *Aircraft, Engines, Etc.*—The aircraft and engines must be of British design and manufacture and the aircraft must be of British nationality.

(c) *Regularity of Service.*—45 completed single journeys in each direction on any one route during each period of three months are necessary in order that a firm may qualify for the subsidy, but on any one day flights need not be made in both directions, and only one flight in the same direction will count as a qualifying flight.

(d) *Speed.*—All flights on the routes so far approved must be completed within four hours to count for qualifying purposes.

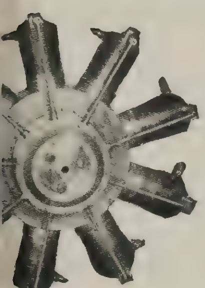
(II) *Tariff.*—The tariff charges and any amendments thereto must be approved by the Air Ministry.

* Unless under special conditions where permission has been given in writing.

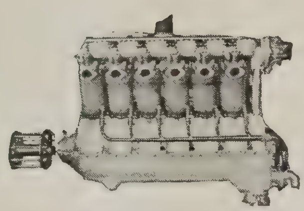
(*Concluded on page* 454)

Engines

laybach	Opel	Thomas-Morse
lercedes	Peugeot	Wright
)berursel	Renault	Salmson
'rankfort	Sturtevant	



GNOME



LIBERTY

ies, Engine Parts, Accessories, Sea Sleds and Hangars

of 111 planes are offered—the following makes are ıted: Glenn Martin, Halberstadt Biplane, Nieuport, ., Pfalz, Pomillien, Roland, Rumpler, Standard Stur- Sopwith. While many are unserviceable and fit only rimental and instruction purposes, some are complete otors and can be made serviceable by careful over- . Prices range from $100 to $1,000 for single planes. alog for complete data.

derable quantity of spare engine parts are offered and such representative items as bushings and fittings; ıtes, oil and water pump parts, magneto parts, pistons, (crank and cam), valves and valve stems, springs, etc. The accessories include tachometers, wheels, es, radiators, generators, fuel tanks, tires and tubes,

ı sleds are a most attractive buy. Prices are at very duction—in one instance more than 80 percent of cost. craft are all finely fitted and most of them are in ıt condition.

alog also gives details on hangars; on more than a of a million aero spark plugs of best domestic and manufacture and other items contained in the sale.

To The Speed Boat Enthusiast

Many of these engines have been converted by purchasers for use as regular marine engines, or as motive power for air driven craft. The catalog gives details, including the manner and cost of conversion to such uses.

S ARMY

TICAL EQUIPMENT

U.S. AIR SERVICE

Sale At Fixed Prices

Terms of Sale

All the material in this sale is offered at fixed prices which are plainly stated in the descriptive catalog sent to all interested in this sale. The terms of sale are in no way involved and shipments will be made promptly.

Everything the prospective purchaser may desire to know will be found in the catalog. Send for it today.

Special Prices in Quantity

On the engines offered, a special price will be given on quantities. Where the purchaser buys the entire lot of a given make of engine, all the spare parts for that engine will be included in the purchase at no extra cost.

All orders, requests for catalogs or information should be addressed to

MATERIAL DISPOSAL
and
SALVAGE DIVISION

AIR SERVICE
WAR DEPARTMENT
1616-B Munitions Building,
Washington, D. C.

FOREIGN TECHNICAL DIGEST

Coupling of Aero-Engines

The author divides aeroplanes into two broad classes, the single-engined machine with one fuselage and air screw, and the multi-engined machine with one or more fuselages and power eggs. The first class has more or less evolved a standard type for all designers, but the second embodies radically different ideas as to the disposition of engines and means of driving the air screw, and the quality of design in the latter class is not so good as in the former.

The first two-engine machines were constructed during the war for carrying heavy loads to a greater height than could be achieved by the single-engine machines, and their construction was more or less empirical and not based on scientific design. The author advocates the coupling of two or more motors on to the same air-screw shaft, with some automatic means of uncoupling in case of breakdown. This involves the use of a variable pitch air screw. The advantages of coupling engines to a single air screw are given as facilities of installation of a super-charger, easier piloting if one motor fails, reduced head resistance, better visibility in front, and less danger in case of crash as the passengers are behind the motors, also the air screw can be of more robust construction than a smaller air screw. A number of existing schemes are quoted, such as the Rosatelli arrangement of the Fiats, the Breguet-Bugatti arrangement, and some German types such as Linke-Hoffmann.

The advantages of coupling present many different problems, but it is necessary that these should be solved so that high-power machines can pursue their natural course of development similar to that on smaller aeroplanes. (Paul Boccaccio, *L'Air,* Feb. 5, 1921. 1 p.)

Progress in Electric Seam Welding Machines

Seam welding was at first effected by continuous and close spot welding. As this process obviously could not give a satisfactorily homogeneous seam, the next step was to replace the pointed electrodes by roller electrodes, by which means the electric weld took place under considerable pressure. Difficulties were, however, experienced owing to the presence of impurities, such as the slight layers of oxide produced by annealing, on the sheets to be welded, particularly at the edges. As these impurities caused burns, they had either to be cleaned off or cut away, causing loss of time and material. These difficulties have been largely eliminated by the new "step-by-step" seam welding process. In this process, the roller does not revolve continuously, but moves forward a short distance and then stands still for a moment. At the moment it stops, the current is automatically switched on, and welding under electrode pressure takes place. The current is then immediately cut off, but the roller rests a moment on the welded spot, whereby a triple effect is obtained—the weld cools under pressure, air is kept from it, and the heat is quickly conducted away by the water-cooled electrode, by which means stresses in the material are avoided. After this pause the cycle of operations begins again. A complete cycle takes so short an interval of time that to the eye the movement of the roller seems continuous. Galvanized and tinned sheets can be welded without burning the deposited metal—the path of the roller shows thereon as a dull white strip. Brass, zinc, nickel, aluminum and alloys can be welded.

Machines are illustrated, various applications described, and particulars of output and energy consumption given. (A. Neuburger, *Elektrotechnik und Marschinenbau,* Dec. 5, 1920. 7 cols., 3 figs.)

Undercarriage Design With Reference to High Wing-Loading.

In order successfully to compete with rail and road traffic an aeroplane must be able to do a given journey in a very much shorter time than that taken by a train or car. Load-carrying pure and simple, and at slow speeds, will undoubtedly come one day; but at present all aerial traffic must be high-speed traffic.

There are two reasons for this: first, an aeroplane is not as safe as a train or a motor-car; and second, it cannot, at the moment, be run as cheaply. Therefore the only inducements to travellers to give up their old method of travel and to use the new are the additional comfort in aeroplanes and the higher speed. The first of these has not very great influence, for the difference is not marked enough, so that the second alone must be relied upon to ensure full loads.*

In order to obtain high speeds in an aeroplane it is necessary to use a high wing-loading. It will have been noticed that speed-record breaking freaks carry the loading to what is considered by the designer to be the highest limit to which he can go and yet allow a highly skilled pilot to land in safety on a good surface. Roughly, it may be said that, assuming good streamline, the speed of a machine with a given engine will be determined by its wing-loading. The larger the wings the greater the resistance. Light loading will lower the stalling speed but, since the resistance varies as the square of the speed, the full speed will be adversely affected to a greater extent.

Since the highest possible full speed is required from the passenger-carrying aeroplane, it behooves the designer to decide what maximum slow speed will give it sufficient safey. The answer depends upon two factors. The controllability and the undercarriage design. With good control it is possible with safety to land—for a machine must be safe while it is flying—an aeroplane with a higher stalling speed than would otherwise be the case. This is reasonably obvious, and is generally accepted as a fact, but it is not so generally realized that undercarriage design influences the wing-loading, although in reality it is this factor which is the more important one.

The only danger in a high-speed landing on an aerodrome lies in turning over on the ground. Forced landings present a slightly different problem, and are not here to be considered. In the case of misjudgment in a landing either by pancaking or by flattening out too late, the highly loaded machine fares worse, since it is travelling faster. It has a more pronounced tendency to bucket.

When, as a result of a bad landing, an aeroplane turns over, it always does so in the following manner: it first buckets or bounces so that the wheels and tail-skid strike the ground alternately. It does this because, for obvious reasons, it is necessary to put the undercarriage axles in front of the centre of gravity. (If the undercarriage wheels were directly under the centre of gravity no bucketing would take place, as the machine would simply bounce straight up and down, maintaining the same attitude relative to the earth.) The bucketing becomes more and more accentuated, and eventually, owing to the wind or the nature of the ground, a wing drops. The tip of this hits the ground before the wheels, the machine swings partly round, the nose catches the earth, and a complete somersault results. Usually very extensive damage is done by these accidents, and sometimes injury to pilot and passengers.

From the foregoing it will be clear that if the wing-tip could be prevented from dropping and the undercarriage were of normal strength, no amount of bucketing would lead to turning the machine over; neither would it even harm it beyond perhaps straining some bracing wires. That an undercarriage can be designed which definitely prevents the wing-tip from dropping has been proved by the "Bantam" and "Basilisk" designs of Mr. Koolhoven. These undercarriages have an unusually wide wheelbase, and the axles are supported, through the usual shock-absorber medium, by vertical struts which bear directly under the inner interplane struts. This type of undercarriage would permit of a high wing-loading being used with safety. On landing in a "Bantam" or "Basilisk" the sensation of security which is given by the curious quick damping out of the lateral oscillations of the machine is remarkable. None of the usual precarious perched-up feeling is noticeable.

It is conceivable that, in the case of single-engined machines, these undercarriages present difficulties from the mechanical structure point of view in that they take the load under the interplane struts. But they present such very marked advantages for practical flying that structural difficulties should be overcome, and, as far as the aeroplanes mentioned are concerned, this seems to have been already accomplished.

With the lessening of the danger of turning over on the ground it would be possible to use much higher wing-loadings and England could attack the world's aerial speed record by building a machine with a high minimum gliding speed and a special wide undercarriage.

It would be extremely interesting to see whether this country is still capable of competing with France for the honor of the record speed in the air.—*Aeronautics, June* 23, 1921.

Bastianelli Flying Boat

The Company Bastianelli, of Rome, constructed a large flying boat which they called PRB1. Span, 30m.; gap, 4m.; total length, 16.50; height, 6.50; surface, 206 sq. m.

The engines are in two power eggs, each containing two motors (Isotta Fraschini V6), driving 2-pusher and 2-tractor air screws.

The engines are 6-cylinder water-cooled, 130 x 180, giving 177 h.p. at 1,300 r.p.m. Total weight empty, 4,000 kg.; useful load, 3,000 kg.; weight per h.p., 7.30 kg.; weight per sq. m., 25.70; radius of action, 10 hours at 160 km./hour; climb to 4,000 m. in 30 mins. 35 secs. (*L'Air,* Feb. 20, 1921. ½ col.)

NAVAL and MILITARY AERONAUTICS

First Air Defense Station on U. S. Coast Completed

The first complete modern aerial coast defense station has just been finished at New Dorp, S. I., and will be turned over officially to the United States Army Air Service as a unit in the national defense next week. It will be designated Miller field and is completely equipped for handling land as well as seaplane patrol aircraft.

It is on the old Vanderbilt estate and covers approximately 450 acres. For seaplane purposes the new field is complete in every way. It has a frontage of 1,750 feet along the ocean, which is protected by a huge pier at one end, and a concrete ramp at the other, the two breakwaters forming a haven for the seaplanes, as well as affording smooth water for taking off and landing.

The beach is equipped with a marine railroad for hoisting seagoing aircraft ashore either for repair or housing. For land machines the field is so arranged that they can alight in any direction, according to the direction of the wind. The field. itself is rectangular in shape, and is surrounded by the permanent buildings that form part of the station. Aeroplanes have a clear running space of 3,200 feet in one direction, and 1,625 feet in the other.

The station is named in honor of Captain James E. Miller, who was killed in action near Corbeny, France, on March 8, 1918. Captain Miller was a member of the 95th Aero Squadron.

In addition to complete facilities for handling all types of aircraft, the new station is equipped with an independent wireless transmitting and receiving station. There is also a radio direction finder that will enable aircraft to locate the station in foggy weather, and guide them in their coastal patrol work.

It was constructed upon plans completed in the closing stages of the war, and its cost came out of appropriations made for war purposes. The function of turning the station over to the Army Air Service from the constructing quartermaster's department will be informal. The new station will be under jurisdiction of the commander of Mitchel Field, L. I.

Navy C-3 Destroyed

Norfolk, Va.—The coolness of Lieutenants B. N. Johnson, commander, and O. O. Atwood, pilot, was responsible, in the opinion of naval officers, for the escape of the entire crew of the naval dirigible C-3 July 7 when the huge blimp caught fire while flying 400 feet above the naval air station at Hampton Roads. The airship exploded soon after it had been brought to the ground by the officers, but the six aboard had escaped to a safe distance and were uninjured except for burns received in the descent.

The fire was caused, it was explained, by the flapping of a rip panel and leaking hydrogen mixing with the air.

With his coat burning, Lieutenant Johnson fought to keep the flames from the fuel tank, and although his right wrist was fractured by a glancing blow from a propeller, he continued his efforts, meanwhile directing the descent of the craft.

Lieutenant Atwood was surrounded by flames as he brought the big bag to earth by a swift drop.

D. R. Russell, official photographer for the air station; S. M. Lemsky, chief machinist, and two other machinists suffered burns.

The dirigible was starting out for a photographic flight when the accident occurred.

The C-3 was one of the C-Class airships built in 1918. Characteristics of the ship are: Gas capacity, 181,000 cubic feet; length, 192 feet; height, 59 feet; extreme width, 53 feet.

Sam Browne Belt Given Official Army Approval

The Sam Browne belt, which was worn by officers of foreign armies and Americans who saw service overseas during the world war, was approved July 6 as part of the regulation issue uniform for officers of the United States army. Under the orders all officers in uniform will be compelled to wear the belt beginning July 15.

Gen. Pershing and his staff continued to wear the belts upon their return from Europe, but all other officers were ordered to discard them. The explanation was made that the belts served to distinguish those who served overseas.

Officers who have worn the Sam Brownes declare they lend an improvement in appearance to the uniform and in addition an aid in carrying sabres and side arms.

Bombing Practice Recommences

The second bombing practice by naval aircraft from North Island is scheduled to begin early in July. The bombing and aerial battle practice will take place over the ocean, off the island, and both sea and shipplanes will be used.

Torpedo and bombing practice will be carried on with loaded missiles by planes traveling at a high rate of speed, from an altitude of about 2,000 feet.

The outcome of the tests being made on the Atlantic coast with bombing aeroplanes has caused considerable interest in local aviation circles. The successful air attack on the former German submarine has already demonstrated the ability of aircraft to carry on warfare with surface craft, and the results of the practice on this coast will no doubt be of great interest to aviation enthusiasts throughout the country.

Senate Gives Up Plan for Pacific Naval Stations

Washington.—After a meeting of Senate and House conferees on the naval appropriation bill July 8 it was said the Senate would drop its fight for retention of certain amendments opposed by the House.

These include provisions for aviation stations at Sand Point, Wash., and Camp Kearny, Cal.; improvements at the Bremerton (Wash.) Navy Yard and construction of two aeroplane carriers.

Searchlight Bettered

Washington.—Experiments by the Navy Department during the past few weeks have shown that Star shells are much safer than searchlights in locating enemy craft.

A "flashless" powder is being used in propelling the shells from the guns. The shells light up the sea for a wide area, and officers explain that if they can be protected without a betraying flash they will be a far advance over the searchlight.

For guns of three inches or smaller the new system is said to work almost perfectly, but in the large guns it is said that all of the flash of discharge has not been eliminated.

Sow Sea Mines From Aeroplane

Washington.—Another new war development that has just been perfected is a plan whereby the ocean can be strewn with contact mines by the use of aircraft. The plan has been tried by American navy experts and found to work perfectly. The result is that mine laying may become a matter of a few hours' work when an emergency arises, instead of days being required to close up lanes of navigation menaced by enemy ships.

The experiments were conducted in Chesapeake Bay. The mechanism, which was invented by Charles Lee, a mechanical engineer of Portsmouth, Va., consists of the usual mine, an anchor, cable and silk parachute. The plane carries the mine to the point desired, and when it is dropped the parachute eases it into the water. The instant the mine strikes the water, the parachute is released, and it floats away to sink from sight in a few minutes, leaving no trace to give the enemy warning of the proximity of danger.

According to the experts, a fleet of aeroplanes, each carrying a supply of mines, can be sent over the area it is desired to mine, and there drop the mines at regular intervals. The whole area can be mined within a very short time, and the planes be away before being sighted by enemy ships and their mission discovered. This, according to the navy experts, is one of the best and quickest means yet discovered of protecting a coast against enemy craft. The fields can be mapped for the protection of home craft as easily as it can be done with the usual method of laying mines from ships.

Another important development in the matter of aviation has been reported to the Government experts from Pittsburgh. It is the discovery of the alloy used by Germany in the manufacture of the framework of the big Zeppelin dirigibles. This formula has been long sought by both American and British scientists, and it was one point in which Germany was far ahead of the rest of the world throughout the war.

The framework of the Zeppelins was made from an aluminum alloy which was much lighter than steel and of great tensile strength. Nothing further was known about it, and the secret was held by the Germans until now. It was long ago determined that one point in the secret was heat treatment, and scores of attempts were made to find the exact temperature necessary to produce the metal in its final perfection, but all these efforts failed to reveal the secret.

FOREIGN NEWS

Mail Service Between Bahamas and Florida

According to Consul Lathrop an act has already passed its first reading in the Bahama House or Assembly by which certain concessions are given to the Bermuda and West Atlantic Aviation Company, a British limited company with registered offices in London. A subsidy of £5,000 per year is provided in the decree for the purpose of carrying mail between Nassau, Bahama, and Miami, Fla. It is expected that the hangar and repair shops constructed by the company will be open to the aeroplanes of all nations on reasonable terms, although at present the bill provides for this only by inference.

Aerial Mail Service in Australia

The Australian Federal Postmaster General's Department is conferring with the Air Council with reference to the practicability of establishing an aerial mail service for Australia, writes Consul General Sammons.

Airships and British Empire Mails

If the scheme propounded by Mr. A. H. Ashbolt, the Agent-General for Tasmania, should be adopted, not only will the British airships be saved from the knacker's yard, but they will be used immediately for the purpose of opening up an Empire-wide air mail service. Considerable correspondence, we understand, has passed between Mr. Ashbolt and the Colonial Office, and has been issued by him for publication. From this it emerges that the purpose of those interested in the scheme is to form an Imperial Air Co. to take over and utilize the airships, plant and other materials now held by the British Government, and which the latter is willing to hand over to such an organization as that which is now proposed should be created.

In brief, the proposal is that the Imperial Air Co. should have a capital of £1,500,000, of which 50 per cent. should be issued at once. The Indian, South African and Australian Governments should subscribe each £100,000, the New Zealand Government £55,000 and that of the Malay States £20,000, a total of £375,000. An equal amount should be subscribed by the general public, while, of course, Great Britain's contribution would consist of the airships, material, etc. The latter would be a free gift, not ranking as capital, but it would be open to the British Government to take up the whole or any part of the share capital of £375,000 which the scheme outlines as being issuable to the public. There is an alternative scheme of distribution, but as this merely deals with the same figures, differently distributed as to amount among the various Governments, we need not trouble to quote its details.

All the Governments concerned would be required to undertake to send mail matter by air between Great Britain and the countries named, subject to the provision that the rates of carriage should not exceed those charged by the steamship services. The Governments would also be required to share profit and loss for a period of ten years, after which time the company would be expected to stand on its own feet. This scheme is to be submitted to the Imperial Conference when it meets, as it will in a very short period from now.

Aviation in the West Indies

A West Indian Aviation Committee has recently been formed, with the approval of the British Colonial Office and the Air Ministry, the object of which is to further the possibilities of commercial aviation in the West Indies. The Committee held its first meeting in London recently, at which a great deal of highly interesting information was forthcoming regarding the possibilities of flying in the islands. They appear to offer an excellent field for the employment of aircraft, particularly of the amphibian type. It was pointed out at the meeting that, although most of the islands are no more than fifty miles apart from each other, communications are difficult and uncertain. Mails are dependent upon a Canadian service which visits the islands once every fortnight. The island of Montserrat, for instance, is not even in telegraphic communication with the outside world, and urgent messages have to be sent by sailing craft, which are often becalmed for days. A single flying boat could visit the whole of these islands in a couple of days.

British Guiana also offers a very fine field for aerial enterprise. Its chief need at the moment is for aerial survey, or at least reconnaissance. Very little is known about the interior, which is mostly almost impenetrable forest land. A little has been done in this direction by the Bermuda and West Atlantic Aviation Company, which runs pleasure flights for tourists as its main purpose in life. This company is, as has been previously mentioned, at present surveying, under contract, certain concessions owned by the British Controlled Oilfields on the Orinoco, in Venezuela. This work has only been started recently, but there is every reason to believe that the results of the survey will be highly successful.

There is not the slightest doubt that it is in countries such as these that aircraft can be of inestimable use in opening up new communications, improving those already existing, and in generally assisting to augment knowledge of the interior and its possibilities for trade and development, even more than along the more beaten tracks of civilization, where communications are reasonably good, and where aircraft are able only to demonstrate the advantage—great, admittedly—of very high comparative speed.

Proposed Air Service between Montevideo and Buenos Aires

It is announced that the Uruguayan postal authorities desire to enter into an arrangement with those of Argentina for the establishment of an aerial postal service between Montevideo and Buenos Aires. It is suggested that the ordinary postal tariff for this new service should be 25 cents. (Uruguayan gold), and that the Uruguayan aeroplane should leave Montevideo daily at 8 a. m., whilst that from Argentina would leave Buenos Aires in the afternoon.

Further Tests on the H.P. Wing

When the first full-size machine fitted with the Handley Page slotted wing was tested some months ago, the slots were, it may be remembered, not provided with operating gear. This meant that the top speed of the machine was spoilt, although showing the great reduction in landing speed obtainable with the slots. Experiments are now being conducted at Cricklewood with various forms of slot-operating gear in order to decide which form to employ on the new monoplane that is now being built. By this policy it may be expected that when the new monoplane is completed and in flying trim she will be far less of an experiment than would have been the case had actual tests not been made upon different forms of slot gear. The tests are being carried out with a D.H.9 *fuselage* fitted as a monoplane, and we understand that, although difficulties have been encountered, there is every reason to expect that a satisfactory gear will be evolved in the near future.

The "Nordstern" Goes to France

At last the Germans have got a move on in regard to delivering the small dirigible "Nordstern" under the terms of the Peace Treaty, her sister ship "Bodensee" having been assigned to Italy. The "Nordstern" was due to arrive from Friedrichshafen at Saint Cyr, where she will be housed in the Zodiac hangar, on June 10 or 11. Weather conditions, however, caused "delivery" to be made on June 13. She was navigated by a German crew, whilst on behalf of France Captains Paquignon, Leroy, and another officer were on board during the journey to France. Both these little commercial ships have done good work in Germany up to such time as the Treaty terms were determined, a regular service having been organized between Friedrichshafen and Berlin-Staaken, with a stop at Munich. The journey there and back was timed for 14 hours and was carried out 100 times in 98 days. It is proposed by M. Laurent-Eynac to reserve the "Nordstern" for the Marseille-Algiers air service, which is now in course of organization.

The "Nordstern" differs from the "Bodensee" but slightly, having a capacity of 777,000 cubic ft. and a length of 382 ft. Her maximum diameter is 60 ft., and the overall height just within 80 ft. The hull is divided up into 13 gas compartments. There are in all four cars, comprising one large one forward, forming the main control station and the cabin for the passengers; two wing cars amidships, each containing a 280 h.p. Maybach; and at the extreme rear a single car containing two 280 h.p. Maybachs. The main cabin accommodates 40 passengers, with 1,100 lbs. of luggage—this being in addition to the crew of 16. She has a speed of about 86 m.p.h., and an endurance of 25 hours.

Another Zeppelin Destroyed

From Milan it is announced that last week one of the two German Zeppelins which Italy lately received has been destroyed, with its hangar, during a gale at Ciampino, near Rome. This large airship, rechristened "Ausonia" was a valuable acquisition to the Italian airfleet, whose craft number half a dozen. No lives were lost.

French Air Mail Lines

In addition to the air mail line between Alexandretta and Aleppo, inaugurated by the French Army of the Levant, another line is projected which is to link up the Syrian coast with Deir-Ez-Zor, an important centre on the Euphrates about 500 km. inland, *via* Homs and Palmyra. This distance could be covered by an aeroplane in three hours, whereas the time now taken from Beyrut to Deir is eight days, one day by rail and then seven by camel across the Syrian Desert. At present Deir has no regular mail connection with the Syrian towns.

The Oxford and Cambridge Air Race

Plans for the Oxford and Cambridge Air Race have now definitely materialized, and it seems that this event, which is to take place on July 16 (Aerial Derby Day) at Hendon, has every prospect of being as popular in the world of sport as its older and aquatic prototype. It is to be a cross-country team race, each University putting up a team of three pilots, all flying S.E. 5 machines. The actual course to be flown is to be kept secret until the morning of the race, but it will be a circuit of about 30 to 40 miles, which is to be covered three times, with Hendon aerodrome as the starting point. The machines will be lined up and will start all together, just before the Aerial Derby. As in ordinary cross-country team racing, the winner will be the team obtaining the minimum aggregate total of place numbers. It will be seen, therefore, that the race should provide plenty of excitement, and is thoroughly "sporty."

It should be mentioned that the Royal Aero Club is bearing the whole of the expenses, including machines, insurance, petrol, etc.

"Bristol" Tourer in Spain

Owing to the serious railway accident which occurred in Spain on Sunday between Madrid and Toledo, the Spanish bull-fighter, Fortuna, found himself unable to reach Algeciras by rail to keep an important engagement. He therefore arranged to make the trip (a distance of 300 miles) by air and on a "Bristol" Tourer, piloted by Major de Havilland, a record flight was made. The enterprise of the famous bull fighter aroused great enthusiasm, and the flight added one more to the list of notable performances of "Bristol" machines in Spain.

Brussels Aero Club Spring Meeting

Piloted by Captain Piercy, a D.H.9A aeroplane returned last week from the Aero Club Spring Meeting, at Brussels, in the "record" time of one hour and a half, equivalent to an average speed of 145 miles per hour. The first prize in the speed tests at the aero meeting was awarded to Lieut. Stampe, the pilot of the King of the Belgians, flying the King's private aeroplane—a British Bristol fighter model. The first prize in the maneuvering capacity tests was secured by Captain Piercy on a Martinsyde, in competition with various foreign types of aeroplanes.

West Australian Air Mail

A Reuter's message from Melbourne states that the route to be followed along the coast of Western Australia by the proposed air mail service, for which the Federal Government is shortly calling for tenders, will be Geraldton, Carnarvon, Onslow, Roeburne, Port Hedland, and Broome. There will be a weekly delivery in both directions. In addition to passengers, each machine will cary mails weighing 100 lbs.

Aerial Derby Entries

The success of the Royal Aero Club's annual Aerial Derby, to be held July 16, has already been assured. It is probable that more than twenty machines will start in the race, covering a double circuit of London, a total distance of 200 miles. It is expected that the winner will exceed the speed of 153.45 miles an hour, attained by F. C. Courtney, the winner of last year's race.

Among those who have already entered the race is Sadi Lecointe with a Nieuport, the holder of the world's speed record of 313.043 kilometers (more than 195 miles) an hour. The entries range from Sadi Lecointe with a Nieuport-Delage, 300 horse power, Hispano-Suiza and an Avrolion 450 horse power Napier engine, to Capt. Tully and Lieut. B. Hinkler with Avrobabys using a 35 horse power Green engine. Others are Capt. Broad in a Sopwith Camel with a 130 horse-power Clerget engine; Capt. Curtis in a B-E-2-E, with a 90 horse power Raf 2-E engine; Lieut. Longton in a S-E-5-A, with a 220 horse power Wolseley Viper engine; Cyril Unwin in a Bristol, with a 400 horse power Bristol Jupiter engine; B. Romanet, winner of last year's Gordon Bennett race, with a Spad, who has attained a speed of 193 miles an hour; F. P. Raynham, and Capt. G. W. Gathergood.

ELEMENTARY AERONAUTICS *and* MODEL NOTES

Light Aeroplane Built With Veneer

ONE of the smallest practical sportplanes in the United States has just been completed by Mr. H. C. Mummert. Both the design and construction were carried out in a real professional manner by Mr. Mummert, who is associated with the Engineering Department of the Curtiss Company's Garden City plant.

Some of the important specifications are as follows:

Span, upper wing	18 feet
Wing chord	31⅝ inches
Gap between wings	33 inches
Wing Section	R. A. F. 15
Total wing area (with ailerons)	90 sq. ft.
Stabilizer area	5 sq. ft.
Elevator area	4 sq. ft.
Fin aera	3 sq. ft.
Rudder area	3 sq. ft.
Weight, empty	350 lbs.
Weight, with pilot and fuel	590 lbs.
Estimated high speed	90 m. p. h.
Landing speed	43 m. p. h.
Engine, Lawrence 2 cyl.	25 h. p.
Propeller, 4.4 ft. pitch	5 ft.

Many new features of design and construction are seen in the various parts of this little plane. Aside from its extremely diminutive proportions, perhaps the most striking feature is the extensive use of veneer. Veneer is used for the entire fuselage, for the covering of the main wings and for the tail surfaces. Besides assisting the rigidity of the wing construction, the employment of veneer for the covering of these wings gives the maximum lift obtainable with the R. A. F.-15 wing curve, as the contour of the wing profile is not subject to the deformation occurring to fabric-covered wings during flight.

What is known as the "Clark Truss" is used for the interplane bracing system. This truss was originated by Col. V. E. Clark, whilst in the service of the Engineering Division of the U. S. Army Air Service. The truss system has many meritorious characteristics, the most prominent of which is the elimination of the usual set of brace cables between upper and lower rear spars, and the entire absence of incidence and drift cables. To replace these, there is but a pair of streamline wires running from the fuselage at the lower wing front spar to the upper wing rear spar. These wires constitute the flying wires and also act as drift wires. As the greatest loading on the wings is carried at the upper rear wing spars these two wires are particularly well placed, as the loading is transmitted directly to the body. There is but a single "landing" wire at each side of the body, which is also streamline, running from the front fuselage strut to the lower wing rear spar at the interplane strut. Interplane struts are of streamline steel tube, constructed of three members welded in a unit to "N" shape as used in the Fokker biplane. At the body there is but a single pair of struts supporting the upper wing. These struts are built right into and formed as a part of the body.

Wings

The upper wing, having a span of 18 feet, is built in one continuous panel, with a cut-away at the trailing edge above the pilot's cockpit. The lower wing is also in the form of a single panel. It is securely attached underneath the body. The wings are built up with a total of 9 spars not including the leading and trailing edges. The spars are rectangular in section, ¼ inch wide and varying in depth according to their disposition in the wing. The upper rear spar is of the box-beam type. This is also true of the lower wing front spar which requires extra stiffness.

Wing tips are semi-elliptical in outline. The entire covering is with 1/16 inch mahogany veneer tacked to all the spars and edges. There are no ailerons on the upper wing. On the lower wing narrow ailerons extend from the wing tip to the body where they are directly connected to the control stick in the pilot's cockpit. The ailerons are set into the wing on steel tubes which leave no gap between the surfaces. As the inner ends of the ailerons are operated by a small lever in the body, there are no external fittings to cause resistance.

Body

The body is of the monocoque type. It was built to streamline shape on a specially constructed form. The veneer is wrapped spirally and reinforced internally by means of light hoops. At the stern the fin (which is in two sections, disposed above and below the body), is built into the fuselage. The lower part of the fin carries the tail skid.

The rudder is operated by cables enclosed in the body and connected to projections in continuation of the fuselage streamline. These projections fit into the stern after the fashion of a socket and therefore are "air tight".

General

The pilot's cockpit is provided with the regulation rudder bar and stick controls. The usual instruments are carried on the dashboard. The pilot's seat is of the bucket type, formed of a continuous strip of aluminum and designed for the pilot's comfort.

The engine is an air-cooled twin-cylinder opposed Lawrence which gives 25 H. P. at 1800 r. p. m. Provision is made for carrying twelve gallons of gasoline and two gallons of lubricating oil. In calculating the performances obtainable, the pilot's weight is figured at 150 pounds, and fuel at 90 pounds.

Wheels are 20"x2" attached with the usual shock-absorber sprung axle. There are but two streamline chassis brace wires. Chassis vees are of ash, streamlined.

It is reported that one of the best known test pilots is to put this machine through the customary flight tests and a summary of his conclusions as to its air worthiness is awaited with interest.

Model Built by Aerial Age Reader

A successful flying model of a "Lawrence" military tractor has been built by Mr. S. I. Scheler of Cadillac, Mich. As the model was required to be flown from snow covered ground, it was provided with long skids constructed from a clock spring which made it possible for the model to rise from soft fluffy snow.

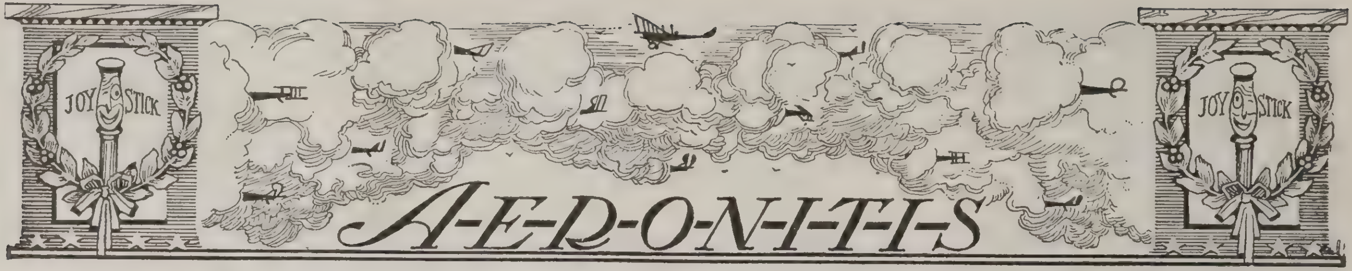
A double-geared ten-inch propeller is used. The wings are carefully built up with channeled wing spars and lightened ribs. The covering is with Jap silk. The general dimensions are:

Upper wing span	36 inches
Lower wing span	24 inches
Chord, upper wing	5½ inches
Chord, lower wing	4¼ inches
Gap between wings	4 inches
Length overall	26 inches
Weight complete	8 ounces

Huntington Monoplane Built in Nebraska

A Huntington monoplane, built from plans secured through the medium of AERIAL AGE, and recently constructed by Mr. John Afflerbaugh of Wood River, Nebraska, has created much enthusiasm among aerial enthusiasts in Wood River. The Huntington monoplane was briefly described in the January 3 and 10 issues of AERIAL AGE. Since the publication of these descriptions, Mr. D. W. Huntington has had numerous requests for detailed plans of the little plane he designed. In response to this demand, Mr. Huntington has undertaken to draw up in very accurate detail every part of the design. One of these blue prints showing the wing assembly and details was examined by a representative of AERIAL AGE and found to be exceptionally neat, reliable and complete in every manner.

Mr. Afflerbaugh tried out his plane with a motorcycle engine but it had too small a crankshaft and kept shearing the keys in the propeller flange. A professional pilot was engaged to make the tests but it was decided to obtain a more reliable engine before further tests are conducted. It is desired to install a 20 to 30 horsepower aviation engine, preferably of the 2 cylinder horizontal opposed type.



Foolishment.

Gob: "Hey, Hackbarth, what has eight legs and sings?"
Marine: "Gee, you got me, unless it is a centipede."
Gob: "I said eight legs, not a million."
Marine: "Well, you got me, what is it?"
Gob: "A quartet."

He Didn't Dare.

The fatherly officer looked over the colored gob who was making his first sea cruise.

"What's the matter, sailor, you look seasick?"

"No, suh; I ain't exactly seasick, but Ah sho am sleepy."

"Why not lie down and take a nap?"

"No, suh, kain't lay down. If Ah lays down Ah'll jes start yawning, and Ah suttingly am powerful scared to yawn."—*Newport Recruit.*

We All Know.

"Just what is the difference between 'results' and 'consequences'?" asked Jimmie of his father.

"Well," answered the father, "results are what you expect, and consequences are what you get."

A Human Machine.

"I see," said the Marine orderly, "that there is a machine invented which can tell just when a man is lying."

"I know," replied the sailor, "We have such a machine on board this ship. He's our skipper."—*Our Navy.*

The Cause.

Joe reported in at sick bay the morning after his return from liberty in awful shape—both eyes blacked, nose broken, lips swollen and cut, an ear torn and clothes wrecked.

"Well, Joe," inquired the corpsman, "whatcha been doin'—fightin'?"

"No," answered Joe pityingly; "no, I was cleanin' out the canary bird's cage and the little rascal bit me."

I Wish I Was in Cloudland.

To the Tune of Dixie.

Don't you wish yo' was at fourteen thousand
Ramblin' roun' above th' cloudland?
    Look away, look away, look away from the land.

In the aeroplane that I was taught in,
Early on one summer mornin'
    Look away, look away, look away from the land.

It was there I passed such merry hours
Almost hittin' th' pilon towers,
    Look away, look away, look away towards th' land.

One day I chose a field and landed—
Missed it and in a tree got stranded,
    Seemed a-way, long way, long way from th' land.

Oh, gay the times we'll have together,
Flyin' about in spite of th' weather,
    Look away, look away, look away from th' land.

It mighty fine when it ain't too windy—
That makes the plane kick up a shindy,
    Look away, look away, look away from th' land.

So sing we now a song that's very
Gay and bright and blithe and merry,
    Look away, look away, look away from the land.

And if you want to drive 'way sorrow,
Come and fly with me tomorrow,
    Look away, look away, look away from th' land.

Then I wish I was in cloudland,
    Hurrah! Hurrah!
In that blue sky I'll stay and fly,
    To live and die a-planing.
Away, away, away up there in cloudland!
Away, away, away up there in cloudland!

J. S. Chapman.

Tennessee—May Ah see you-all home?
New Jersey—You're drunk, man; there's only one of me.

—*Punch Bowl.*

Unidentified

"Shay, did you see me come in?"
"Yes, I saw you come in."
"Well—hic—ever see me before?"
"No, I never saw you before."
"Then—hic—how did you know it was me?"

—*Orange Peel.*

"How did Dick get the broken leg?"

"Oh, he went into a local shoe shine parlor, and remarked that it would be a good thing for the country if every Greek would kill a negro and get electrocuted for it."

—*Wag Jag.*

Two little worms were digging away. They were digging in dead earnest.—Poor Ernest!!

—*Purple Cow.*

"Alas, he has fainted away."
"Fear not, I'll bring him to."
"Bring three, I'll have one myself."

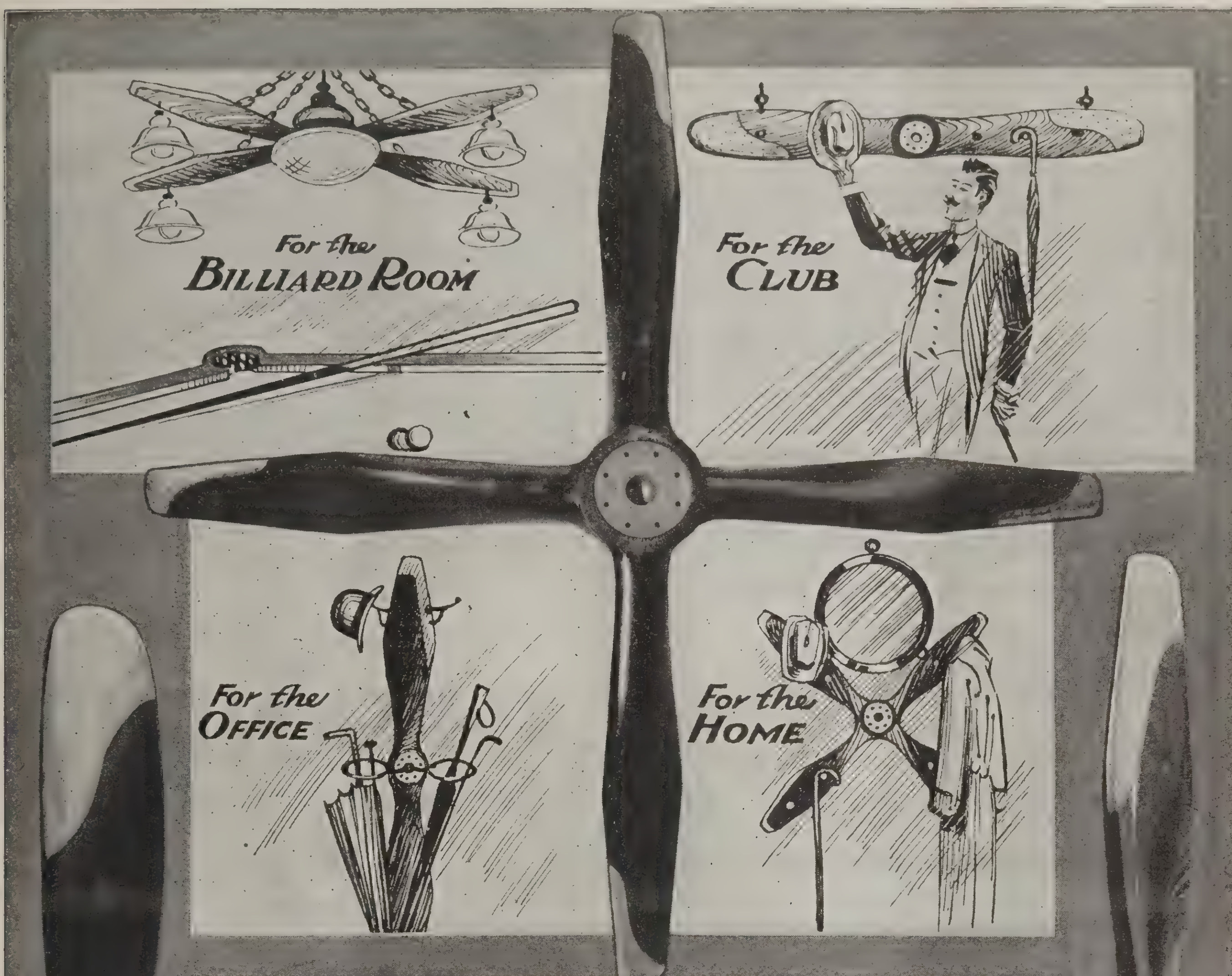
—*Purple Cow.*

He—What shape is a kiss?
She—I don't know.
He—Well, give me one, and we'll call it square.

—*Voo Doo.*

Cleo—When Bill danced with me last night he kept letting his hand slip down my back.
Patricia—I hope you rebuked him.
Cleo—I did; I told him to keep it up.

—*Purple Cow.*



FULL-SIZED PROPELLER AND TWO YEARS OF AERIAL AGE FOR $10.00

THROUGH an arrangement which we have consummated with the organization that purchased large quantities of Air Service Propellers, we are enabled to present an opportunity to every reader of Aerial Age to secure a full size aeroplane propeller—an admirable souvenir that every aeronautic enthusiast will want to secure. Some of the uses to which these propellers may be put are indicated on this page. They originally cost from $85 to $150 each, and are now obtainable, together with a subscription to *Aerial Age*, for a ridiculously small price.

To each person sending us a subscription for two years (or two subscriptions for one year each) and enclosing their check for $10.00, we will send a two-bladed propeller, properly cased, freight charges to be paid on delivery by the addressee. If a four-bladed propeller is desired a check for $13.00 should be remitted for the subscriptions and propeller.

................................ORDER BLANK:................................

Please find my check enclosed herewith for $.........., for which enter subscriptions, and send propeller as per enclosed memorandum.

Name..

Address..

AERIAL AGE WEEKLY, 280 Madison Ave., New York City

WING COVERING

Doping, Pigmenting, Enameling, Varnishing accurately, quickly and economically done

LINEN, LINEN TAPE, LINEN COVERS, DOPE

Grade A Linen—90c per yard
Grade A Cotton—50c per yard
Scalloped Cotton Tape—6c per yard

AVIATION MOTORS

Overhauled and Repaired by French Engineers
Rotary Engines a Specialty

G. VOISIN, Expert

20 years of practical experience

Tel. 139 W. Hasb. Hgts. 236 Franklin Ave., Hasbrouck Heights, N. J.
Factory: 70-72 Rome St., Newark, N. J. Tel. Market 9170.

Baker's A-A Castor Oil

Specially Refined
for the Lubrication of
AERONAUTICAL MOTORS

BAKER CASTOR OIL COMPANY
Founded 1857
The Oldest and Largest Manufacturers of Castor Oil in the United States
120 BROADWAY NEW YORK

CANUCK

AND

OX5 ENGINE SPARE PARTS

IMMEDIATE DELIVERY

C. A. L. PROPS $20 PARAGON PROPS $30

ROME-TURNEY RADIATORS $23

Also Complete Assortment of Standard Utility Parts

Get Our Prices Before Ordering

AIRCRAFT MATERIALS & EQUIPT. CORP.
1409 SEDGWICK AVE. NEW YORK CITY

ECONOMY

IS NOT JUST A QUESTION OF LOW FIRST COST
BUT ALSO
LONG SERVICE and RELIABILITY

USE

TITANINE

TRADE MARK

DOPES and COVERING MATERIALS

MADE BY

TITANINE Inc.

Morris & Elmwood Aves. Union, Union County, N. J.

The ACE Planes are

Built for the man who loves the air regardless of the business that calls him.

AVIATION SCHOOLS
Solo Students on the ACE

HORACE KEANE
Aero Planes Inc.
Sales Office: 505 Fifth Ave., N. Y.
Factory: North Beach, Long Island

FLYING SCHOOL

Our Graduates Are Satisfied

YOU WILL BE TOO

If you come to this school for a flying course.
Students enroll every day in the year
Students graduate every day in the year
Your license assured—fair treatment guaranteed.

Write for booklet.

PHILADELPHIA AERO-SERVICE CORPORATION

636 Real Estate Trust Bldg. Philadelphia

New Aeroplane Supply Sale

Acetate Dope Guaranteed 55 Gal. Drum and 50 Gal. Bbls. **$1.00** per Gal. No charge for containers. 5 Gal. lots **$2.25** per Gal.

Spar Varnish, 5 Gal. cans, **$2.25** per Gal.

Green Brown Wing Enamel, 5 Gal. cans, **$1.50** per Gal.

TYCOS ALTIMETERS, register 20,000 feet radium, **$15.00** each.

New Leather Aviation Helmets, **$5.00** each, cost **$18.00.**

½" Brass Gasoline Stop Valves, **$2.00** per Doz.

AC Spark Plugs Metrics **$3.00** per Doz. **$20.00** per hundred. **$180.00** per M.

Liberty Aero Oil, 50 Gal. barrels, **75c** per Gal. Worth double.

4" Barrel Turnbuckles **$3.00** per Doz. **$15.00** per hundred.

Wicker Pilot Seats, **$4.00** each, **$36.00** per Doz.

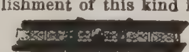
Tufted Fabricoid covered, cushions for above **$1.25** each.

Size No. 2½ Tinned Tacks, **15c** per lb.

MAX TOPPER & ROSENTHAL
11th Ave. & P.R.R. Tracks Columbus, Ohio

Students of Aviation, Model Builders and Experimenters

The Wading River Model Airplane & Supply Co., as the oldest establishment of this kind in the U. S., is able to supply you with the best material at the most reasonable prices.



Scale Drawings and Blueprints of some of the latest types always on hand.

We also make models to your own plans at reasonable prices.
Send $.05 for Illustrated Catalog.

WADING RIVER MFG. CO., 672 Broadway, Brooklyn, N. Y.

ANOTHER JN-4D REDUCTION!

TWO NEW SHIPS **$2750** ea.
THREE REBUILT SHIPS **$1500** ea.

Quoted subject to prior sale.

CURTISS EASTERN AIRPLANE CORP.
130 So. 15th Street, Philadelphia, Pa.

AVIATION
FLYING AND GROUND SCHOOL

COURSES TAKEN SEPARATELY OR COMBINED

We have the very best of flying instructors. Our ground instructors will teach you motors from A-Z and show you how to build an airplane from the ground up.

We specialize on MOTOR MECHANICS and RIGGERS

and can turn you out qualified to handle such position paying from $200 to $300 monthly.

Write for descriptive literature.

THE LOWELL AIRCRAFT CO., Inc.
Oberlin, Ohio

Fairchild Aerial Camera Corporation

has received inquiries for aerial views illustrating points of interest in Seattle, Portland, San Francisco, Los Angeles, Chicago, Boston, Philadelphia, Washington, Baltimore, Niagara Falls, Yellowstone, Yosemite, and Mt. Rainier National Parks. If you have pictures from these sections we will be glad to sell them for you.

136 WEST 52nd STREET, NEW YORK CITY

"Airplane Supplies"

NATIONAL AEROPLANE COMPANY
549 W. Washington St. CHICAGO, ILL.

CANUCKS $1,500 TO $2,500

REBUILT—READY TO FLY AWAY

OX5 MOTORS—REBUILT A-1 $300
OXX and OX5 spare parts new—
CANUCK & "D" spare parts—lowest prices
1 "D" new left lower panel—$150-special job
JN radiators—need very slight repairs $15
New Round OXX radiators $30

DE LUXE AIR SERVICE, Inc., Asbury Park, N. J.

STONE MANUFACTURING CO., Inc.
Supreme Propellers

For immediate delivery

Future Location, 2623 Olive St., ST. LOUIS, MO.
Pioneer Propeller Builders Established 1910

Advertising in this department 10c a word $2.00 minimum

Classified Advertising

Forms close for this department on Monday preceding date of issue

PATENTS Ex-Pilot U. S. Air Service
ALLEN E. PECK
Patent Attorney
Pacific Bldg., Washington, D. C.

FOR SALE—New upper wings Farman Pusher span 56 ft. two sections. Suitable glider or experimental work. Sacrifice. Address Box 600, c/o Aerial Age Weekly, 280 Madison Ave., New York City.

FOR SALE—All OX5 motor parts brand new, reasonable prices. For example: Crank shafts $50.00. Pistons $6. Champion spark plugs $.75. Address The Lowell Aircraft Co., Oberlin, Ohio.

PHILADELPHIANS desirous of building flivver aeroplane write Box 602, c/o Aerial Age Weekly, 280 Madison Ave., New York City.

FOR SALE—Four passenger Curtiss flying boat with Hispano-Suiza motor, flown about twenty hours, now flying. Will demonstrate anywhere. Bargain for quick sale. Address Box 1050, New Haven, Conn.

RELIABLE PILOT AND MECHANIC desires flying position, anything considered. Will go anywhere. Excellent references furnished. Address LeRoy Thomson, Woodbury, Conn.

CANUCK AND OX5 PARTS at big discounts, unlimited supply C. A. L. propellers at $20. Other bargains. Specify your wants. Address Chas. H. Paterson, 6504 South State St., Chicago, Ill.

FOR SALE—New French Breguet bombing plane with speed of 130 miles and carrying capacity of 1500 lbs. Now arranged to carry two passengers but can easily be altered so that it will carry four. Address Box 77, Kokomo, Ind.

REBUILT DE HAVILAND 6, 2-place, $1600. 3-place $1800. Try them, fly them, and you will surely buy one. Let us show you. Walter Shaffer Airplane Agency, Dauphin, Pa.

FOR SALE—One Aeromarine aeroplane, Thomas motor, landing gear, set up ready to fly. Will sell on terms to responsible party. Strubler Aero Co., Colorado Springs, Colo.

FOR SALE—Three passenger triplane in excellent condition. Wreck accepted as part payment. Address G. H. Johnson, 428 High St., Burlington, N. J.

PILOT WITH EXPERIENCE on land and seaplanes both, will consider any proposition anywhere. 500 hours Army Air Service. F. W. Caldwell, 910 Leader News Bldg., Cleveland, Ohio.

LOWEST PRICES on new OX5 Hammondsports. Write or wire Wallace Bros., Bettendorf, Iowa.

FOR SALE—New Liberty motor parts, reasonable price, immediate shipment. Also brand new Curtiss OX5 cylinders. Never uncrated. Address Grant Motor Co., 912 E. Grand Blvd., Detroit, Mich.

FUSELAGE AND TAIL SURFACES for JN4-D. For sale cheap John Porter, Wabash, Ind.

YOUNG MAN desires position with aeroplane company or private party, best references. Address Rupert Sims, Santa Anna, Texas.

PARACHUTE JUMPER desires position with motion picture corporation or private parachute company. Two years of aerial experience. Best references. Address Box 601, c/o Aerial Age Weekly, 280 Madison Ave., New York City.

COMPLETE F-BOAT OUTFIT—2 planes OXX6 motors, extra wings, etc. All in fine condition. Sacrifice for quick sale. Address J. B. R. Verplanck, Fishkill-on-Hudson, N.Y.

FOR SALE, CHEAP if taken at once. Two new Curtiss JN4 with genuine Hammondsport motors. Address Ed. Sundholm, Albert City, Iowa.

FOR TRADE—Canuck aeroplane, rebuilt motor, first class condition, to trade for automobile worth the money. Canadian aeroplane complete, less motor, to trade for car. Address R. S. Pipkin, 1007 F. & M. Bank Building, Fort Worth, Texas.

BRAND NEW DH6 THREE SEATER, with OX motor. Demonstration at Hazelhurst Field by appointment. A bargain at $1500.00. Write or call Room 1003, 299 Madison Ave., New York City.

FOR SALE CHEAP—Army aviation supplies, including wings, ailerons, elevators, stabilizers, fuselages, undercarriages, etc. We are making exceptionally low prices in order to dispose of this stuff in a short time. Write for our special price list. Haug's Independent Airplane Co., 1007 F. & M. Bank Bldg., Fort Worth, Texas.

PILOT WITH 2800 HOURS, experienced field manager, expert mechanic, desires connection with well established aeroplane manufacturing company doing experimental work. Test pilot or sales manager. Address Box 604, c/o Aerial Age Weekly, 280 Madison Ave., New York City.

WANTED—PILOT for a flying boat. Navy man preferred with log book. Must be reliable and work on percentage. No amateurs need apply. Address R. B. Fournier, Aerial Taxi & Rapid Transit, foot of E. Water St., Sandusky, Ohio.

DOPE $2.25 gallon. Genuine aeroplane linen 75c yard. Cotton fabric 50c yard. Linen tape 8c yard. "Standard" J1 fuselage, empennage and landing gear, complete, special, only $300. R. H. Canuck wings (rebuilt) uncovered $50 each. Center panel, covered, $20. Rudder $10. Elevators $10. Ostergaard Aircraft Works, 3215 Lake St., Chicago, Ill.

CANUCK WINGS, ailerons, fittings, etc., for sale very cheap. In good condition. Harrisburg Airplane Co., Harrisburg, Pa.

FOR SALE—Canuck, now flying, fine shape, good motor and performs to equal any. Price very low, including contract for large fair. Would consider good car in trade. Address Box 286, Hopkinsville, Ky.

CANUCKS—Two rebuilt, recovered Canucks with spares including motor for $3300. Or sell singly at low figure. Can demonstrate. Address MacShort, Salina, Kans.

FOR SALE—"F" Boat. Beautifully finished, natural wood hull, aluminum wings. Never been used. $2500. Also used "F" boat, very good condition $1200. Address P. E. Easter, 318 Woodlawn Road, Baltimore, Md.

WANTED — Position as mechanic or mechanic's helper with firm or private party. Have made solo flights. Address Box 603, c/o Aerial Age Weekly, 280 Madison Ave., New York City.

TWO AMERICAN JN FOR SALE, 1 JN4D, 1 JN4A. Both ships are in first class condition. Motors on first overhaul. One motor 15 hours; other about 35 hours. Address J. F. Casey, c/o DeLuxe Air Service, Inc., Asbury Park, N. J.

FOR SALE—JN4 American Curtiss ready to fly away. Must sell quick. First reasonable offer takes same. Write A. B. Agnew, Templeton, Pa.

FOR SALE—Four brand new eight double head magnetos with switches, $80 each F.O.B. San Francisco, Cal. Address E. O. Teall, 324 Main St., San Francisco, Cal.

WILL EXCHANGE Marmom 34 touring car in excellent condition for aeroplane in good condition. For full particulars address Sturgeon Bay Aero Co., Box 412, Sturgeon Bay, Wis.

(*Continued from page* 443)

(III) *Accounts.*—(a) Approved firms will be required to render to the Air Ministry monthly statements showing their gross earnings for the month on each route operated by them.

In addition with each such statement will be required a certificate to the effect that no rebates of any kind have been granted, or are due, except as specified in the accounts.

(b) Payment, on account, not exceeding 20% of the firm's gross earnings from the carriage of passengers, goods, parcels and mails will be paid by Air Ministry monthly, subject to final verification of the information supplied by the firm and subject to annual adjustment of the amounts paid by the Air Ministry so that the total annual payment as subsidy will be 25% of the firm's gross earnings.

(c) Approved firms will be required to keep their accounts in such a form that the gross earnings and running costs of individual machines on individual flights can readily be identified.

An annual balance sheet certified by auditors together with profit and loss accounts and records showing full details of cost of starting, maintaining and operating the services for which the subsidy is claimed must be produced for examination by the Air Ministry who will also have access to the firm's books, receipts and other documents in support of their claim before the final sum due for the year will become payable.

The air Ministry will provide:

(a) Meteorological information and ground wireless services, free of charge, at the Government aerodromes.

(b) Terminal and emergency aerodromes in Great Britain together with all aerodrome facilities, including lighting, etc., so far as the Air Ministry funds permit, subject to the payment of the recognized charges.

The Ar Ministry invite those who are interested in the commercial development of aerial transport services to submit proposals to the Secretary (C.G.C.A.) Air Ministry, Kingsway, W.C. 2, for consideration, not later than Monday, April 1 next.

Proposals submitted should state the amount of subscribed cash capital that will be employed on the undertaking, the number and types of machines proposed to be operated, the number of pilots proposed to be employed, together with information concerning the previous experience of the promoters and management in aerial transport and any other information which may help the Air Council in the selection of a limited number of firms that could be assisted within the limits of the money available.

The Air Council reserve the right to accept or refuse any proposal submitted.

Girl Makes 15,200 Ft. Parachute Jump

St. Paul.—From an atmosphere of 10 degrees below zero back to 98 in the shade in twenty minutes, eighteen-year-old Phoebe Fairgrave of St. Paul was the most novel and thrilling experience she enjoyed July 10, when she shattered all existing altitude records for women parachute jumpers with a leap of 15,200 feet.

Piloted by V. C. Omlie, Miss Fairgrave left the Curtiss flying field, St. Paul, at 5:30 p.m. while 15,000 persons looked on. For sixty-five minutes the plane climbed until the altimeter registered 15,200 feet.

"My hands were purple with cold," Miss Fairgrave said today; "for the first time in my life I was really scared. My fingers were so benumbed that I feared I could not cling to the struts while I attached the parachute to my 'harness.'

"It took every ounce of my strength I could muster up to step out on the wings. As soon as I moved my body became somewhat warmed and I was able to attach the parachute to my belt. Waving to Omlie, I jumped. For the first 200 feet I fell like a bullet, then the chute opened up, and I began to swing back and forth. At about 2,000 feet I struck another dead air pocket and dropped straight down for 200 feet more. After that everything went along smoothly until I landed in that wheat field, a mile south of New Brighton."

Miss Fairgrave lives at 918 Graves Avenue, St. Paul, and was graduated from Mechanics Arts High School a year ago. She worked as a stenographer for two weeks following graduation, "but just couldn't stand being cooped up in an office," she said.

New French Year Book

A new aerial year book has recently been published in France, entitled L'Annee Aeronautique 1920-1921, par L. Hirschauer et Ch. Dollfus. Dunod, Publisher. This year book covers the following material:

1st Part—Specifications of aeroplanes with illustrations given. Includes all models of the year.

2nd Part—World records; cups, prizes, etc.; big aeroplane flights; sporting events.

3rd Part—Expositions (includes New York).

4th Part—Commercial aviations: 1. List of lines and where they operate; includes all European lines. 2. Economic information about air lines; incorporation, etc.

Appendix: Excellent trade directory.

AERIAL AGE
WEEKLY

L. 13, No. 20 JULY 25, 1921 10 CENTS A COPY

Airscape of City College, New York. Photographed for the Fairchild Aerial Camera Corp. by W. L. Hamilton

The One-Plane Navy

ISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
iptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

AERONAUTIC BOOKS

Test Methods for Mechanical Fabrics

By George B. Haven, Associate Professor of Mechanical Engineering, Massachusetts Institute of Technology. Contents.—Aerodynamics. Wind Tunnels. Wings. Resistance. Estimation of Performance. Stress Analysis (by Prof. Howard B. Luther, of Massachusetts Institute of Technology). Weight Estimation. Airscrews. Motors. Materials of Construction. [Wiley.]

Principles of Airplane Design

By George Marshall Denkinger, Research Aeronautical Engineer, Air Service, U. S. A., and Clarence Dean Hanscom, formerly Research Aeronautical Engineer, Air Service, U. S. A. (In preparation. Ready Spring, 1921.) Vol. I. [illegible]ical and Experimental Aerodynamics. [illegible]s.—Aerodynamics. Wind Tunnels. Wings. [illegible]ce. Vol. II. Applied Aerodynamics. [illegible].—Estimation of Performance. Stress [illegible] Weight Estimation. Air Screws. Motors. Materials of Construction. [Wiley.]

Aeronautics—A Class Text

By Edwin Bidwell Wilson, Ph.D., Professor of Mathematical Physics in the Massachusetts Institute of Technology. 265 pages. 6 by 9. 31 figures. Cloth. Postpaid $4.25.

Covers those portions of dynamics, both rigid and fluid, which are fundamental in aeronautical engineering. It presupposes some knowledge of calculus. The book will prove stimulating to other than technical students of aeronautical engineering. Contents.—Introduction. Mathematical Preliminaries. The Pressure On a Plane. The Skeleton Airplane. Rigid Mechanics. Motion in a Resisting Medium. Harmonic Motion. Motion in Two Dimensions. Motion in Three Dimensions. Stability of the Airplane. Fluid Mechanics. Motion Along a Tube. Planar Motion. Theory of Dimensions. Forces On An Airplane. Stream Function, Velocity Potential. Motion of a Body in a Liquid. Motion in Three Dimensions. Index. [Wiley.]

The Dynamics of the Airplane

By K. P. Williams, Ph.D., Associate Professor of Mathematics, Indiana University. (No. 21 of Mathematical Monographs, Edited by Mansfield Merriman and Robert S. Woodward.) 138 pages. 6 by 9. 50 figures. Cloth. Postpaid $2.75.

An introduction to the dynamical problems connected with the motion of an aeroplane, for the student of mathematics or physics. While not written for the person interested mainly with design and construction, most of the questions treated have some interest for anyone who is familiar with the entire field of aeronautics. The development of the French writers is followed more closely than that of the English and American, the author believing that it is worth while to make a treatment of this general sort accessible to American students of mathematics. Contents.—The Plane and Cambered Surface. Straight Horizontal Flight. Descent and Ascent. Circular Flight: 1. Horizontal Turns. 2. Circular Descent. The Propeller. Performance: 1. Ceiling. 2. Radius of Action. Stability and Controllability: Longitudinal Stability. Stability in Rolling. Lateral Stability. [Wiley.]

Learning to Fly in the U. S. Army

By E. N. Fales. 180 pages. 5 x 7. Illustrated. Postpaid $1.75.

In this book are set forth the main principles of flying which the aviator must know in order properly to understand his aeroplane, to keep it trued up, and to operate it in cross country flight as well as at the flying field. The material presented is all standard information, previously available to students only in fragmentary form, but not up to this time collected and arranged in logical order for study and quick reference. Contents.—I. History of Aviation. II. Types of Military Airplanes and Uses. III. Principles of Flight. IV. Flying the Airplane. V. Cross-Country Flying. VI. The Rigging of Airplanes—Nomenclature. VII. Materials of Construction. VIII. Erecting Airplanes. IX. Truing Up the Fuselage. X. Handling of Airplanes in the Field and At the Bases Previous to and After Flights. XI. Inspection of Airplanes. [McGraw.]

Aircraft Mechanics Handbook

By Fred H. Colvin, Editor of American Machinist. 402 pages. 5 by 7. 193 illustrations. Postpaid $4.25. New Edition.

A book specifically for the aircraft mechanic. During the war it was extensively used as a textbook in the U. S. Navy Training Stations, the Army Flying Fields and Schools of Military Aeronautics. It covers briefly the principles of construction, and gives in detail methods of erecting and adjusting the plane. The book is especially complete on the care and repair of motors. Descriptions of the various types of military aeroplanes and engines are given. The photographs and cuts show the principles and practice of adjustment and operation. [McGraw.]

Airplane Design and Construction

By Ottorino Pomilio. 403 pages. 6 by 9. Illustrated. Postpaid $5.25.

This was the first book to be published in this country which presents in detail the application of aerodynamic research to practical aeroplane design and construction. Although the feat of flying in a heavier than air machine was first accomplished in America, the major part of experimental work in aerodynamics has been conducted in Europe. The Pomilios of Italy have had an important part in this experimental work. The data presented in this book should enable designers and manufacturers to save both time and expense. The arrangement, presentation of subject matter, and explanation of the derivation of working formulae together with the assumptions upon which they are based and consequently their limitations, are such that the book should be indispensable to the practical designer and to the student. [McGraw.]

Radio Engineering Principles

By Henri Lauer, formerly Lieutenant, Signal Corps, U. S. A., Assistant in the Preparation of Training Literature on Radio Theory and Equipment, and Harry L. Brown, formerly Captain, Signal Corps, U. S. A., in charge of the Preparation of the Technical Training Literature used in the Signal Service. 304 pages. 6 by 9. 250 illustrations. Postpaid $3.75.

This is the first book to bring the science of radio up to date—to include the wonderful developments made during the war. In no other book published in this country is there such complete information on vacuum tubes. About one-half of Lauer and Brown's "Radio Engineering Principles" is devoted to the discussion of the three-electrode vacuum tube, taking up its use as detector, amplifier, oscillator and modulator. The book covers thoroughly the operation and characteristics of two- and three-electrode vacuum tubes, the practical applications of the tubes, the generation and control of electron flow, and the conditions which must obtain to cause a tube to operate in any of its functions. Aeroplane and submarine radio theory is discussed in detail. Other special applications of the vacuum tube are also treated. Lauer and Brown's "Radio Engineering Principles" is the authoritative modern textbook on the subject. [McGraw.]

Standard Handbook for Electrical Engineers

Frank F. Fowle, Editor-in-Chief, assisted by over sixty leading specialists. 25 thumb-indexed sections. 2000 pages. 4 by 7. Flexible. Illustrated. Postpaid $7.40 net.

The "Standard" is the most widely-used electrical book in the world. It is quoted everywhere as the final authority on electrical engineering. It has been endorsed by the leading electrical journals here and abroad. It is an encyclopedia of electrical engineering. Its twenty-five thoroughly indexed sections cover every phase of the subject. The book is the work of more than sixty of the world's foremost electrical engineers. It has been called a triumph of engineering cooperation because of its completeness, its reliability, and its get-at-ableness. [McGraw.]

The Aeroplane Speaks

By H. Barber, A. F. Ae. S. (Captain, Royal Flying Corps). Postpaid $3.25.

Captain Barber, whose experience in designing, building and flying aeroplanes extends over a period of eight years, has written this book to be of assistance to the pilot and his aids. Lucid and well illustrated chapters on flight, stability and control, rigging, propellers and maintenance are followed by a glossary of aeronautical terms and thirty-five plates illustrating the various types of aeroplanes and their development from the first practical flying machine. An introduction presents, in the form of conversations between the various parts of the aeroplane, a simple explanation of the principles of flight, written, says the author, "to help the ordinary man to understand the aeroplane and the joys and troubles of its pilot." [McBride.]

Aeroplane Design

By F. S. Barnwell. With a Simple Explanation of Inherent Stability—By W. H. Sayers. With diagrams. Postpaid $1.10.

Mr. Barnwell, who is well known as a highly successful designer, holds a commission in the Royal Flying Corps. The section of this book written by him formed a treatise read before the Engineering Society of Glasgow University. Mr. W. H. Sayers in the second part of the volume elucidates a problem that has been the occasion of much discussion among mathematicians—that of inherent stability. Both sections are fully illustrated by diagrams. This book has been adopted by the U. S. Government as a text book for the instruction of aviators. [McBride.]

Aerobatics

By Horatio Barber, A. F. Ae. S. With 29 half-tone plates showing the principal evolutions. Postpaid $3.50.

This book by Captain Barber, whose earlier work, "The Aeroplane Speaks", is recognized as the standard textbook on ground work and the theory of flight, is an explanation in simple form, and for the benefit of the student, of the general rules governing elementary and advanced flying. Part I, which is headed "Elementary Flying", is an explanation of the essential elements of flight instruction from the moment the student enters the machine until he becomes a finished pilot. The mechanical control of the machine, straight flying, turns of all kinds, stalling, diving, gliding, slide-slips, and various ways of landing, flying through clouds, "taxying" and the first solo flight are described and analyzed fully and in non-technical language, each subject being taken up in progressive order. Part II explains the more advanced evolutions such as looping, spinning, the half roll, the complete roll, the Immelman turn, the falling leaf, the cart wheel, etc. The book contains a progressive syllabus of instruction, a glossary of technical terms and numerous advisory hints. [McBride.]

Flying Guide and Log Book

By Bruce Eytinge. With a Foreword by H. M. Hickam, Major, Air Service. 1921 edition, enlarged and revised to date. 150 pages. 4¾ by 7¼. 38 illustrations, including many photographs of landing fields, and a 24-page Pilot's Log Book for Machine, Motor and Flying. Cloth. Postpaid $2.75.

This book contains valuable information for the aviator, and also, for all those who are interested in, and helping to develop, commercial aviation. Contents.—Calendar. Identification. Frontispiece. Foreword. Past and Present (Poem). Introduction. Don'ts. Helpful Hints. Landing Field Report (Questionnaire). Airdromes—Landing Fields. War Department Orders: Specifications for Municipal Landing Fields. General Flying Rules to Be Observed At All U. S. Flying Fields. Cross-Country Flight Regulations. Rules of the Air. Flying Certificates for Pilots. Trouble Shooting in Airplane Engines. America's Aviation Facilities—Landing Fields (Alphabetically Listed Under Each State). Trans-Continental Aerial Mail Route. Air Routes (Round the Rim Flight). Pilot's Log Book for Machine, Motor and Flying. [Wiley.]

All orders must be accompanied by check—no books sent on approval

Address: Book Department

AERIAL AGE WEEKLY **280 Madison Avenue, New York**

AERIAL AGE WEEKLY

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIII NEW YORK, JULY 25, 1921. No. 19

The One-Plane Navy

THE naval appropriation bill as finally passed may scarcely be regarded a glorious achievement. Born of ideas that were developed under the preceding Administration, which unerringly muddled naval matters, it is not marked by many modern conceptions. It provides few up-to-date weapons. In defiance of reason it practically ignores submarines and aircraft.

Thus framed, the bill was foisted upon the Republican Congress by hold-over influences and strongly approved by the House. The Senate, while obstinately clinging to the unamended 1916 program for a powerful surface or one-plane fleet at tremendous cost, attempted to add $100,000,000 for additional personnel and for submarines and aircraft. But the people demanded economy and the House threw out the Senate amendments, leaving us with a one-plane fleet in a three-plane navy era. It is a story of obstinate departmental conservatism, followed by Congressional mismanagement under both administrations.

Conservatism in the navy within reasonable limits is a steadying influence, but extreme conservatism breeds obtuseness and pigheadedness. It smothers intelligence, balks progress and lessens the fighting efficiency of the navy.

Naval officers must realize that this is an age of invention and of revolution in warfare afloat and ashore. At such a time they must have receptive minds, not single track minds. They must lead, not follow. They must place our navy ahead of, not behind, foreign navies. They must help the people and Congress to save, not to waste, money in the formulation of naval measures. They must be farsighted, not blind. If they lead the country into the expenditure of vast sums without providing an up-to-date navy that can meet the conditions of future war on the sea they will lose the confidence of the people.

The action of Congress is a perpetuation of the 1916 building program, without the slightest consideration to the progress and lessons of the intervening years, years in which all previous concepts of naval warfare were rudely shattered.

When the Senate committee was conducting its investigation and securing opinions pro and con not one naval aviator or submarine expert was permitted to appear. But General Mitchell by sheer courage got some facts before the committee at the last minute, and the committee in a temporary rally from its naval stupor injected into the measure provision for aeroplane carriers and a few submarines. But the House rebelled and cut out the little bit of modernity which the bill carried.

And so with no fleet submarines, no cruising submarines, and a lamentably small air force, our one-plane navy is helpless in modern war. The bureaus have won and conservatism triumphed.

Aircraft frankly has flown away with all the honors for fast sinking of the German war vessels, of which three destroyers and three submarines already have been destroyed. Whether this record is to be maintained in the destruction of the heavier types, the cruiser and the battleship, remains to be demonstrated, although the full force of aircraft may not be felt, since the size of the bombs to be used will be limited to 600 pounds.

In the sinking of the two German destroyers V-43 and the S-132, aeroplanes accomplished what American destroyers found it impossible to do, making a better showing even than the most modern of the American battleships, with their secondary batteries. The battleships sunk the destroyers in twenty-seven minutes, and an hour and seventeen minutes, respectively, while aeroplanes did the same thing with another one-time German destroyer, the G-102, in twenty minutes flat. The war vessels fired 340 shots, while the aeroplanes dropped but ninety-one bombs, part of which weighed only twenty-five pounds, being of the type intended to drive off anti-aircraft personnel, and not to accomplish the sinking. Only forty-four heavy detonation bombs were used—weighing 300 pounds.

One of the important bearings the tests will have in naval development will come out of the record made by the destroyers, which, while they managed to hit the two Germans, failed to sink them with their 4 inch batteries. Gunfire, of course, has been the secondary purpose of destroyers, the launching of torpedoes and the ability to ply at high speed coming first. Just the same the tendency has been in destroyer construction to develop them into fast cruisers, with light batteries.

One of the important features was the demonstrated ability of destroyers to remain afloat in the fact of heavy gunfire. The German destroyers, to the surprise of all the observers, remained afloat for a long time after they had been riddled with shells. And this despite the fact they carried no armor plate, this having been sacrificed to lighten the vessels to obtain greater speed.

Only the shells that hit below the water line were effective in the sinking. Such hits in the recent sinkings were remarkably few, the majority of the shells that struck going to the superstructure, where, while it would have made it uncomfortable for the personnel, they could not be accepted as vital.

The News of the Week

Army Planes Sink German Destroyer in Twenty Minutes

The German destroyer G-102 was sunk in twenty minutes, July 13, by bombs dropped from army aeroplanes flying from Langley Field, seventy-five miles away. She went down by the bow following a spectacular attack in which approximately fifty aeroplanes and three dirigible balloons participated.

The sinking was accomplished by bombs weighing 300 pounds. Of these forty-four were dropped. Within five minutes after the firing began the destroyer was in a sinking condition, but it remained afloat until the fortieth bomb fell squarely on the bow, shattering the forward portion so completely she turned her nose into the water and was swallowed up within a minute. The stern turned up, gave a shudder, and disappeared.

The attack with 300-pound bombs came after a group of pursuit planes of the Z type had dropped forty-four 25-pound bombs and another group of DH-4 planes had dropped three bombs of 100 pounds. Theoretically these preliminary attacks were to clear the way for the heavy bombers, by ridding the air of hostile aircraft and putting anti-aircraft guns out of commission.

Actual battle conditions were simulated in the manoeuvers which continued an hour and twenty minutes. Army aircraft alone participated, constituting a bombardment wing, a provisional tactical unit composed in this instance of forty-three aeroplanes of three sizes, eleven pursuit planes, fifteen light bombers and seventeen heavy bombers. The air contained a dozen or so other aeroplanes and some seaplanes, for observation and similar purposes. In a DH-4 with Major T. J. Milling, chief of staff at Langley Field, was Brig.-Gen. William Mitchell, assistant chief of the army air service, whose day it was to prove the efficiency of land aeroplanes operating far out to sea against naval vessels.

The eleven single-seater pursuit planes, carrying the 25-pound bombs, arrived in V formation, but as they approached the target at 1,000 feet altitude they strung out in file. Each of these aeroplanes carried four bombs, and they dived as they dropped them one at a time, some of the planes going to within 150 feet of the target. It was not to be expected these light bombs would damage the German destroyer to any extent. They were to put the anti-aircraft guns out of commission and get rid of hostile aircraft. These single-seaters established a record of virtually 50 per cent. of hits. They followed each other around and around, dropping the bombs at intervals. Out of the forty-four bombs dropped fully seventeen could be seen from the *Henderson* to hit the deck of the destroyer, while six shots were uncertain, or duds.

By this time the squadron of DH-4 planes, each with six 100-pound bombs aboard, put in an appearance and, close behind them, a squadron of Martin bombers. The Martins were flying at an altitude of approximately 3,000 feet and they dropped bombs two at a time. There was some rather bad firing at first, the bombs hitting wide of the mark, but the succeeding aeroplanes as they came along in file closed to a greater extent so they came close to the vessel's side. The thirteenth plane over made a direct hit with one of its shots and came very close with the other.

These two shots put the destroyer in a sinking condition. It was about six minutes after the firing of the heavy bombs began. The vessel was going down slowly by the bow. Within five minutes more her decks were awash.

Still the Martins kept on, circling in the single file. That succeeding bombs which hit in the water very close to the side assisted in the sinking cannot be questioned, but it was the fortieth bomb that did the business. This missile hit just beyond the bridge, undoubtedly shattering all the forward portion of the vessel. The destroyer gave a lurch, a roll and then started to glide into the water. The stern tilted upward, exposing the rudder for an instant, and then the whole disappeared.

Just as the ship went under another bomb fell at the spot and it looked as though it would have been a hit. The Board of Observers fixed the time of the sinking at 10:40 and the time of the start of the heavy bombing at 10:20.

The Late Harry G. Hawker

Harry G. Hawker, Australian aviator, who in 1919 attempted the first non-stop transatlantic aeroplane flight, only to have to descend and await rescue in mid-ocean, was killed on the Hendon, England, flying field, July 12, when his plane crashed to the ground.

The plane plunged down in flames. Hawker's body was found two hundred yards from the spot where the machine fell.

Hawker's proverbial luck had often been the subject of comment. It remained with him for many years as an experimental and test flyer, from which work, it was said, he received not less than $100,000 yearly.

He is survived by his wife and small daughter, Pamela. He was twenty-nine years old.

Hawker stood out as a hero of transatlantic flying because of his nerve in hopping off in a plane that carried neither life raft nor landing carriage nor convoy ship to fly a longer distance than had ever before been covered in a non-stop flight, with almost sure death awaiting him if he failed. He did fail, after covering 1,225 miles, but with his navigator, Lieutenant Commander Mackenzie Grieve, he was picked up in mid-ocean by the Danish tramp ship *Mary* that ploughed along at seven knots an hour for six days before it could notify the world that the "lost" aviators were safe.

Would Control Flying Fields

On the heels of the fatal aeroplane crash at Langlin Field in Moundsville, W. Va., President La Guardia of the Board of Aldermen of New York City, who also is head of the aerial police, has an ordinance for the Board of Aldermen which will give the police authority over all aviation fields in the city. Major La Guardia wants the department to have the power to close any that do not conform to the regulations of the police.

The request is the outcome of an investigation of several fields in New York from which passengers have been taken on little experience flights, notably the one at Ocean Parkway.

"The field from which these men have been taking their passengers," said Major La Guardia, "is entirely too small, and we believe that some action should be taken before an accident results. I am going to ask the aldermen to give us this authority until November, when we can take the whole matter up in a larger and more effective way.

"I believe that there must be an intelligent and comprehensive dealing with the whole question of air traffic regulation in this city. As a matter of fact, every one interested in the development of aerial navigation favors this. The manufacturers, the fliers themselves, and the aero organizations will all welcome the proper kind of control. They realize that every preventable accident is a set-back to the extension of air travel.

"I do not want to be understood as saying that there are any extraordinary perils in the air. As a matter of fact, it furnishes a smaller percentage of accidents than automobile travel. But many accidents are preventable by taking the proper precautions, and we must not fail to do this."

Aviation Day at Seymour

Seymour, Ind.—"Aviation Day," the first for Seymour, was celebrated July 8.

The celebration was held under the auspices of the Chamber of Commerce. No wide invitations were sent out, since it was a home celebration in the interests of

The Giant Remington-Burnelli Airliner and the Baby Mummert Sportplane. The designer of the Baby, H. C. Mummert, is shown on the right of the picture

the establishing of the Western Airline Company's engineering division here, and the day was spent in educating the people of Jackson County in aeronautics.

Those from out of town who assisted were: Major Longanecker and Lieutenant Charles McK Robinson, of Ft. Benjamin Harrison Air Service station; W. M. Fagley, Sec'y of the Curtiss Indiana Co., Kokomo, Ind.; W. S. Sanders, Sec'y of the Indianapolis Aero Ass'n, together with their several assistants arriving in ships during the morning, and later in the afternoon making flights over the city.

The evening program was held in Schenck Park, and plans were well formulated for a big aviation meet to be held late this fall.

The program and speaking was one of the most interesting ever given in Seymour.

Chairman E. M. Billings, President of the First National Bank, gave a short address on the objects and purposes of "Aviation Day."

W. M. Fagley, of Kokomo, spoke on the possibilities of aviation.

C. B. Smith, editor of the *Tribune Republican,* told of the benefits Seymour had already and would derive by and from the Western Airline Company's locating its plant here.

S. N. Vaughn, Secretary of the Seymour Chamber of Commerce, in a stirring address, told of the investigation by his organization of the possibilities and plans of the Western Airline Co. and gave praise to the activities of Mr. C. E. Lay, its president.

Col. C. E. Lay, President of the Western Airline Co., gave a short talk explaining briefly the plans of the company and a general description and comparison of the new motors which the company are now manufacturing.

W. S. Sanders, Secretary of the Indianapolis Aero Ass'n, gave a most interesting address on the public support of aviation.

F. L. Carter, Chairman of the Worlds Aerial Derby Committee of the Seymour Chamber of Commerce, claimed that aviation would increase Seymour's population 10,000 in the next two years.

The Late Volara R. Nelson

Miss Volara R. Nelson, the first woman to secure the expert license from the Aero Club of America, was killed in an automobile accident at Holdredge, Nebraska, on July 3rd. She was driving a racing car, which overturned on the bend of the Speedway, and received injuries from which she died immediately.

Miss Nelson was widely known and respected in the aeronautic fraternity.

Jacuzzi Plane Wrecked

Oakland, Cal.—An aeroplane from the Jacuzzi Brothers' aeroplane factory in Berkeley, presumably the seven-passenger monoplane recently described in AERIAL AGE, fell at Modesto, killing the pilot and three passengers July 14, according to word received by the *Oakland Tribune*.

The plane was piloted by "Bud" Coffey, a commercial pilot, and the passengers were Giocondo Jacuzzi, builder of the machine, and John Kauke and A. MacLeish, employees of the Jacuzzi works.

The machine caught fire in midair and in falling struck a high voltage electric wire. The occupants of the machine were burned almost beyond recognition.

Kokomo and New Orleans Legislate

At a recent meeting of the Kokomo, Ind., city council there was passed an aircraft ordinance to regulate the minimum altitude at which aeroplanes may pass over the city.

A police regulation which recently came into force at New Orleans provides for the arrest of aviators flying dangerously low over crowded areas.

W. B. A. C. Plans

The Worlds Board of Aeronautical Commissioners, Inc., has been increased to ninety-eight. Commissioners in eighty-one countries and colonies of the world.

On recommendation of the Commissioners, the Board of Governors are appointing a Divisional Chairman of the Board in all the States of the Union, and the Provinces of the several countries and colonies. Thus far the acceptances in the United States are generally accompanied by letters of enthusiasm and encouragement as to the advancement of aeronautics.

Hills Grove Landing Field

Hills Grove Aviation Field is located northward of Apponaug, about 6 miles southward of Providence, and about 200 yards eastward of the New York, New Haven & Hartford Railroad tracks.

There is a hangar on the field, about 60 by 150 feet, with regulation marker on the roof. There is also a half-mile race track on the field. The best part of the field to land on is between the race track and the road, running north and south. A sausage or flag on the hangar will indicate the direction of the wind.

There is a garage on the field that carries Bessemer aviation gas, etc. The field has been used by the Government for De Haviland planes on several occasions.

Canada Postpones Regulations

Information has been received through the Department of State that the period during which American pilots and aircraft will be permitted to fly in Canada under existing conditions has been extended six months from May 1, 1921.

CLOUD FLYING

By BRUCE EYTINGE

HAVING read from the Air Service News Letter, with great interest, an account of Lt. Van Gandt's Dayton to Washington flight in a DH-4B, equipped with cloud flying instruments, I feel that my experience of cross-country flying in the BaCo "Skylark," the first commercial aeroplane to be equipped with cloud-flying instruments, should be of interest and possibly of value to other pilots.

The majority of pilots have, at some time or other, been caught in a storm or have had to fly through clouds and fog. Even the best pilots do not hesitate to admit that it is highly undesirable and far from being absolutely safe.

Cloud flying is not difficult nor dangerous, especially if your machine is equipped with the necessary reliable instruments, and providing the clouds do not come too close to the ground. But that is always the trouble; providing.

Fog is the most dangerous, more so than storms or clouds. Storm clouds can be seen to form and approach while the pilot can climb over, around or land under them before they break, while it is yet possible to pick out a field; and then again, providing there are fields to pick out. If not! You are kicked out.

Fog is different. You cannot see it form nor fly over or around it to advantage. It is impossible to fly under it because it hangs too close to the ground and it is unwise and unsafe to land in it. To start out in a fog or through clouds as low as 500 feet is not unsafe if you know that the weather conditions are more favorable at your objective, but to start out, say from Bethlehem, Pa., through heavy rain clouds that were just skimming the hilltops, driven by wind in the direction of our proposed flight, and knowing that we would have to fly through unknown depths and density of clouds and that upon arrival somewhere over Long Island we would have to come down to within five hundred feet of the ground before we even had a chance to try to locate Mitchel Field, would be unwise as well as unsafe. We did not hesitate to decide to wait. My passenger, nor I, had never flown the route before, and that made a great difference.

Safety first will be the most valuable safety factor towards rapidly developing aviation; and that does not only apply to commercial aviation. It applies to the Army, the Navy, Marine, and Postal Aviation services equally as well. Every pilot regardless of his service, must exercise the keenest judgment before the flight as well as during it.

Every accident is a set-back to the encouraging development of aviation. Decreased accidents and increased development.

In the morning of the day of our flight from Bethlehem, Pa., to Garden City, L. I., we knew that the clouds over Mitchel Field were only 500 feet high because we had gone to the trouble and expense of telephoning to the Field regardless of more favorable newspaper weather reports. At noon we again telephoned, only to be discouraged, but at 4 P. M. Mitchel Field's Meteorological Station reported clouds rising and breaking up and a light west wind. It was comparatively clear at our starting point, so we decided to hop-off at once, knowing that our objective would be easy to locate and more so by the time of our arrival as the west wind was causing the clouds to be dissipated and driven out to sea.

As the flight progressed the visibility increased and after passing numerous clouds between 2,000 and 6,000 feet elevation, and the more or less usual haze over New York, we could easily see the field ten minutes before landing on it.

The above is of no material value for cross-country flying, but it should tend to bring out the importance of knowing thoroughly the existing weather conditions en route before starting.

The route of 105 miles from Garden City to southwest of Philadelphia was also new to the writer, and was flown alone. This route is easy because of the many good prominent land marks, together with the aid of a compass, such as the various race tracks on Long Island, the Bay, Staten Island, the river to the right at New Brunswick, Carnegie Lake at Princeton, the Delaware River through Trenton, leading straight into Philadelphia, and the small rough landing field which is three

(*Concluded on page* 467)

The AIRCRAFT TRADE REVIEW

Goodyear Dirigibles and Balloons Ordered

Orders for three large dirigibles and 38 observation balloons have just been placed with the Goodyear Tire & Rubber Company.

Two patrol and scouting airships of 180,000 cubic feet gas capacity will be built for the navy and will be completed next spring. A dirigible of similar size but of a special Goodyear design will be completed for the army by November. All three will be tested at the Goodyear-Akron air station.

The military airship to be built for the army will have many new features of design that makes it the most up-to-date craft in either arm of the service. It will be the first dirigible in America to have its motors in the car instead of in separate power units. Two propellers will be driven by bevel gears at a two to one ratio with transmission placed on outriggers instead of the motors driving direct to shafts. This will allow the engines to run while the propellers are idle by throwing out clutches, and will also permit propellers to be reversed—a new feature that will permit greater facility in landing. Either motor can drive both propellers in the event that one motor develops trouble. With both motors inboard, they can be overhauled in flight much easier than if they were on outriggers, as in the present types of airship.

The army ship will be 170 feet long and 45 feet in diameter. It will be powered by two 125 horsepower Aeromarine motors, which will operate at 1600 revolutions per minute, but owing to the reduction gear, the propellers will make but 800 revolutions per minute, giving greater efficiency at higher speeds. A speed of 60 miles an hour is expected. The ship's "ceiling" is 10,000 feet.

The gas bags will be of pony blimp shape—"fatter" than other types—thus decreasing head resistance.

The car will be entirely enclosed and will house a crew of six, although three men can operate the dirigible for peacetime purposes.

The army will use this airship probably for border patrol, while the two navy ships will be used for scouting and observation.

New Denver Company

The Aerial Navigation & Engineering Co., with offices in the Foster Building, Denver, Colorado, has been organized for the purpose of operating an airline between Denver and Chicago, via Kansas City and St. Louis, thus forging a link in the first aerial trans-continental air trunk line.

The line will be equipped with a number of freight and passenger-carrying machines of a type which has been tried and proven a commercial success.

The ships operating over the Aerial Navigation & Engineering Company's airways will be in direct communication with the terminals at all times by wireless. Emergency landing fields will be established over the route every ten to fifteen miles. All lines will be operated night and day, this being made possible by illuminating all emergency landing fields and airdromes.

The organizers of the Aerial Navigation & Engineering Co. are N. H. Steele, President; J. P. Skrdlant, Vice-President and General Manager, and R. S. Waugh, Secretary-Treasurer and Chief Engineer.

N. H. Steele has been connected with aviation since the year 1914 as a designer and builder of aeroplanes. He has also had considerable experience as an organizer of commercial aerial companies, and is an able business executive.

J. P. Skrlant, up until recently, was connected with the Royal Air Force, after which he spent a great deal of time studying the methods of operation of the European air lines.

R. S. Waugh, formerly of the U. S. N. A. S., saw service on the Italian front. As an engineer he possesses unusual ability, the necessity of which is so essential for the success of an airline.

McCook Field Bulletins Available

Major H. M. Hickam, chief of the Information Group of the Air Service, through Lt. W. V. Andrews, informs us that there are a number of complete sets of McCook Field Bulletins available to manufacturers, designers and others engaged in aeronautical endeavors. Those desiring a set should communicate with the Office of the Chief of Air Service, Washington, D. C.

Ansaldo Cruiser to Mexico

Aero Import Co. of New York recently received the second Ansaldo 6-seater cabin cruiser to arrive in this country. The ship has now been forwarded by express to Juarez, Mexico, consigned to George Puflea, the American pilot who some time ago completed a remarkable flight from Lincoln, Nebraska, to Mexico City in a Lincoln Standard machine.

As soon as the ship reaches Mexico, a non-stop flight will be attempted from Chihuahua to Mexico City, an airline distance of 1,087 miles.

The all-around performance and reliability of these ships was established early in May by a splendid flight made by Ralph Diggins and passengers between New York and Chicago, which was negotiated in 7½ hours' flying time, as well as by numerous flights in Italy.

Yellowstone Pathfinders

The Yellowstone Air Route will shortly dispatch an aeroplane along the route of the Yellowstone Trail to plan airdromes and at the same time to promote interest in aviation.

The company intends to cover the territory from the eastern boundary of Montana to Chicago. It is being assisted in this work by the Civil Affairs Division of the Army Air Service with advice as to the location and planning of airdromes. Similar work is also being done westward to the Pacific Coast.

Recent Flights of the Cloudster

Saturday, June 25th, the *Cloudster* set what is believed to be a new world's record for aeroplanes using a Liberty motor of 400 horsepower and for single engined aeroplanes regardless of horsepower. The *Cloudster* on this occasion took off, flew and landed successfully at March Field, California, with a gross weight of 9,600 lbs., of which 5,100 lbs. was useful load. The load consisted of two men, David R. Davis, owner of the plane, and Eric Springer, pilot, 670 gallons of gasoline, 55 gallons of oil, 27 gallons of water and much miscellaneous equipment, such as parachutes, etc. Facts of interest in connection with the flight and adding to the accomplishment are the altitude of March Field, 1,500 ft. above sea level, the fact that there was not a breath of air stirring to aid in getting off, and the fact that the plane took off in less than 2,500 ft.

Monday, June 27th, the *Cloudster* left March Field at 6 a. m. with the same load as on the 25th, except that the gasoline supply had been cut down to 600 gallons. The plane circled until an altitude of 2,500 ft. above the field had been maintained (true altitude 4,000 ft.) and then headed for El Centro in an attempt to make a non-stop flight to the Atlantic Coast. Flying over the desert region of Arizona, the plane encountered bumpy weather, which tossed it around like a feather and the barograph record of the flight shows constant drops of 500 feet followed by slow climbing to regain altitude. The rough air brought on a siege of illness for the pilots, and when they found themselves confronted by a storm in the vicinity of El Paso, Texas, they concluded to land, which they did at Fort Bliss. They made a very successful landing, but were hit by the full fury of the combined hail and windstorm before they could get the big ship in a hangar. The plane was blown backwards, resulting in damage to the tailskid bulkhead and the trailing edge of one wing. These parts are now being repaired and the trip will be attempted again, probably towards the end of July. The plane was in the air for 8 hrs. and 45 min. and covered a total of approximately 785 miles. Gasoline consumption averaged slightly less than 24 gallons an hour. An altitude of 8,000 ft. was attained. The speed and climbing ability of the plane with its heavy load and the gasoline consumption on the trip prove the contention of the builders that it is capable of a sustained flight of more than 33 hours.

Planes to Link Trade With Russia

In anticipation of the resumption of trade relations the countries neighboring on Soviet Russia are making a study of the improvement of communications. The German Sablatnig Aeroplane Company, affiliated with the North German Lloyd, plans to compete with the Hamburg-America Company for the privilege of transporting shipments across Poland, which will be indispensable at the conclusion of a trade agreement with Poland.

An aviation company with service between Warsaw and Vilna is negotiating with the Soviet and Polish Governments for the extension of the service to Moscow. Another line connecting Vilna, Riga and Petrograd is planned.

THE WATERMAN RACING MONOPLANE

THIS machine was designed and built to compete in the coming Los Angeles Speedway races to be held on July 16th, and therefore only three factors were taken into consideration in its design. These are: As fast a machine as possible with a stock OX-5 motor, a machine with as great a visibility as possible and at the same time one that would handle well on the sharp turns. The resultant design has therefore not been one of particular beauty or graceful lines nor one of low landing speed or great climb. However, after due consideration of the various types, it was decided to build a machine of the parsol monoplane type with a thin wing section.

In order to completely streamline the required motor, it was necessary to build a fuselage of porportions larger than the orthodox. In this particular instance, however, this has become a very desirable feature, as the large keel area has proven to be indispensable in making a sharp turn at a high speed. Below are the general specifications of the machine:

General Specifications

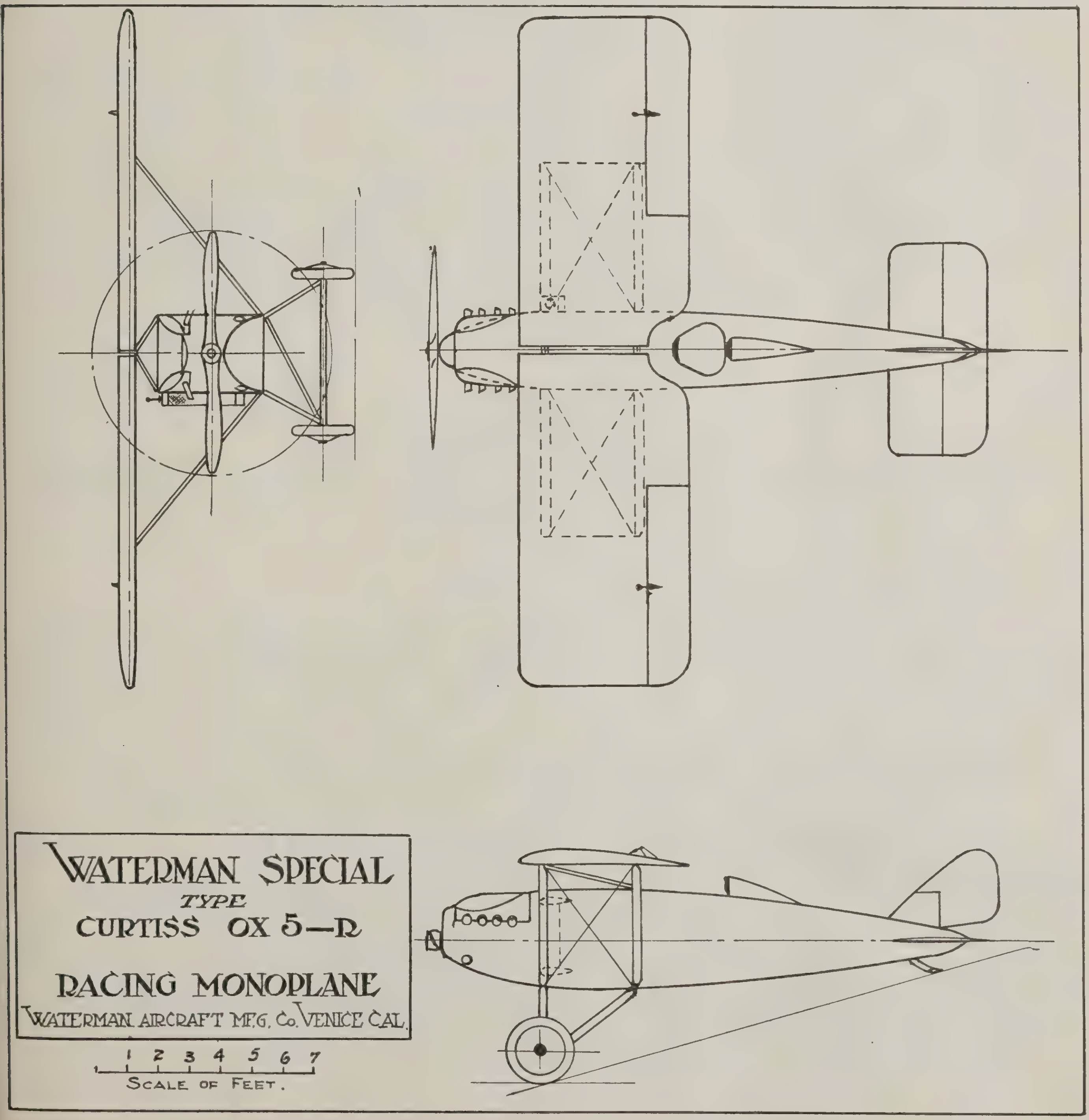
Curtis OX-5	90 h.p.
Weight, empty	885 lbs.
Useful load—pilot, 10 gal. gasoline, 12 quarts oil, 245 lbs.	
Speed (maximum)	130 m.p.h.
Speed (landing)	60 m.p.h.
Speed (cruising)	110 m.p.h.
Load per sq. ft.	11.1 lbs.
Load per h.p.	12.5 lbs.
Spread	21 ft. 9 in.
Chord	66 in.
Total lifting area	112 sq. ft.
Wing curve	U.S.A. 15
Stagger and sweep back	None
Range (full speed)	120 miles
Range (cruising speed)	135 miles

Area

Rudder	5 sq. ft.
Fin	1½ sq. ft.
Ailerons	16 sq. ft.
Elevator	10 sq. ft.
Horizontal stabilizer	12 sq. ft.

Weights

Fuselage complete with tanks, seat, controls, instruments and accessories	224 lbs.
Motor complete with propeller	405 lbs.
Radiator	23 lbs.
Water	28 lbs.



Tail surfaces	35 lbs.
Wings, struts, ailerons, etc.	115 lbs.
Landing gear	55 lbs.
Total weight, empty	885 lbs.

Fuselage

The fuselage is of orthodox longeron bulkhead and plywood construction. There are six bulkheads of fir varying from 6 ply by 5/8 inch to 9 ply by 7/8 inch. These are spaced approximately evenly from the front of the engine sills to the rudder post. The maximum cross-section of the fuselage occurs just to the rear of the motor and is 31 inches by 39½ inches. The longerons are 1⅛ inches square at the point of maximum depth and taper to 7/8 inch square at the rudder post. They are unspliced and of spruce. The veneer facing is 3 ply, 3/20-inch basswood and birch. Instead of tapering to a knife edge at the rudder post the fuselage ends abruptly with a square cross-section of 12 inches by 12 inches. At this point there is attached an aluminum fairing 16 inches long.

The Waterman Racing Monoplane

Wings

The wings are built up in pairs using standard web and cap strip construction with box beams. They are hinged to a tubular pylon at their roots and are again supported at a point 72 inches from the root by tubular struts from the lower longerons. Single drift and anti drift Hartshorne wires are used on each side. These wires take practically all the tension load while the struts merely take the compression load. The box beams are unusually heavy especially at their point of intersection with the overhang struts.

Landing Gear

Steel tube is used throughout the construction of the under carriage which is rigid. The struts are hinged to suitable fittings at the bottom longeron. As there are no shock absorbers, an exceedingly light and simple gear has been obtained, but not one which would be highly recommended for landing in rough fields. Crosswires have been entirely done away with by placing a diagonal tube carrying both tension and compression. The whole gear has been streamlines with wooden fairing wrapped with doped tape. 26-inch by 3-inch wheels and tires are used on the 1½-inch axel.

Controls and Directive Surfaces

Both the rudder and elevator controls are entirely enclosed in the fairing at the rear of the fuselage and are operated through a system of staggard cranks and cables. This makes it possible to eliminate absolutely all external control wires and masts in the tail unit. The ailerons are operated by a system of push-and-pull rods and bellcranks, all of which are completely enclosed except for a short horn on each aileron. The entering edges of all control surfaces are rounded and set into recesses in such a way that there is at no time any gap between the surface and the number to which it is hinged.

Motor Installation

The motor is completely cowled in. A gravity gasoline system with a 20-inch head eliminates the customary bother of the usual pressure systems. A large door in the rear of the aluminum fire wall gives immediate access to the carburetor for any adjustments or cleaning which may be found necessary. A small window in the side of the fuselage permits the inspector of the oil gage in the side of the crankcase. The cooling system consists of but one radiator placed on the right hand side about 9 inches to the rear of the rear cylinder. In so placing the radiator the pressure caused by its being off center just compensates for the motor torque and eliminates the usual necessity for carrying right rudder while flying a straight course. A propeller 7 ft. 9 inches in diameter with a 7-ft. pitch to which is fastened a small aluminum spinner is used.

As the machine is for the Mercury Aviation Company, it has been finished in their customary colors of Mercury red and black which gives it an exceedingly pleasing appearance in the air.

THE DYNAMOMETER HUB AND THE FLYWHEEL OF THE ENGINE[1]

By E. EVERLING

(Technical Note of the National Advisory Committee for Aeronautics)

At the Aero-Technical Conference of the "Wissenschaftliche Gesellschaft für Luftfahrt," held on April 23, 1919, one of the most important of the objections brought forward by Herr Seppeler[2] with regard to the dynamometer hub[3] was that "the engine must continue to retain its flywheel."

As this opinion delayed the development of the dynamometer hub at that time, and it might even now give rise to erroneous views concerning its merit, we shall make a brief investigation of the extent to which the dynamometer affects the well-known flywheel action of the propeller. This point will be discussed later on, and will be applied to coupling, toothed gear, etc.

W. Hoff[4] has proved that the want of symmetry of a 4-cylinder 100 H.P. engine is reduced from 0.517 to 1/180 kg. m/sec.² of the inertia moment through the weight of the propeller. The unequalized damping effect of the power obtained enters into the calculation as in the case of every power machine—in this case it is the resistance of the air, which increases with the square of the number of revolutions and brakes the acceleration of the screw, but which augments the diminution of velocity.

This *resistance of the air,* which is not generally taken into account, is yet of actual importance when a movable organ, such as the dynamometer, is inserted between the engine and the propeller, as the propeller then oscillates freely between a capsule tappet-rod and a collar, with a clearance of about 5°. In place of the usual rigid joint between the engine and the propeller, the *closed circuit* is here brought about by the resistance of the air. The following article will show that *this coupling suffices to ensure the flywheel action of the engine.* We must then find out to what extent the engine may be retarded until the propeller is lifted in consequence of its inertia to the resistance of the hammer of the rotary moment capsule, so that it oscillates freely or strikes against the stop. The retarding rotary moment must then be at least equivalent to the rotary moment absorbed by the propeller:

$$O \cdot \frac{d^2 \phi}{dt^2} = O \cdot \frac{d\omega}{dt} = -M = -M_o \cdot \frac{\quad}{\omega_o^2} \qquad (1)$$

in which O = the moment of inertia (in kg. m/ sec.²) ϕ is the angle of rotation, $\omega = \frac{d\phi}{dt}$ the angular velocity (s^{-1}), M the rotary moment (kgm) absorbed by the propeller, M_o the value of which for $\omega = \omega_o$.

---

[1] From "Zeitschrift für Flugtechnik und Motorluftschiffahrt," Vol. X, Nos. 17/18. Obtained by the courtesy of Prof. K. Kutzbach.

[2] See "Zeitschrift für Flugtechnik und Motorluftschiffahrt," Nos. 9/10, p. 112.

[3] The Dynamometer of the D. V. L. is written by W. Stieber, in "Technische Berichte," Vol. III, p. 221. Compare measurements of same in "T. B.," Vol. I, p. 54, by E. Everling.

[4] Compare W. Hoff, "Jahrbuch der Deutschen Versuchsanstalt für Luftfahrt," Vol. I, 1912-13, p. 224.

By integrating (1), we get the following equation for the decrease of the angular velocity of the freely running propeller (initial velocity ω_o)

$$\omega = \frac{\omega_o}{1 + \frac{M_o}{\Theta\omega_o} \cdot t} \quad \ldots\ldots\ldots\ldots (2)$$

That is, for the proportional decrease of angular velocity due to the braking action:

$$1 - \frac{\omega}{\omega_o} = \frac{1}{\frac{\Theta\,\omega_o}{M_o \cdot t} + 1} \quad \ldots\ldots\ldots\ldots\ldots (3)$$

If we replace the angular velocity by the ordinary number of rotations per minute n or n_o and insert Hoff's numerical value, the result is as follows:

$$1 - \frac{n}{n_o} = \frac{1}{\frac{\eta}{30} \cdot \frac{\Theta\,n_o}{M_o\,t} + 1} =$$

$$= \frac{1}{\frac{\eta}{30} \cdot \frac{0.517}{45.6\,t}\,n_o + 1} = \frac{1}{\frac{n_o}{840\,t} + 1} \quad \ldots (4)$$

especially when the normal number of revolutions $n_o = 1{,}200$ r.p.m.

$$1 - \frac{n}{1200} = \frac{1}{\frac{10}{7\,t} + 1} \quad \ldots\ldots\ldots\ldots\ldots (5)$$

This value, therefore, represents the highest possible variation in the number of revolutions during the time, t, above which the propeller becomes free; that is, the flywheel effect ceases. The time between the sparking of two cylinders may therefore be:

$$t = \frac{60}{1200.2} = \frac{1}{40}\,s$$

The variations in the number of rotations amount to a maximum of 21 r.p.m. in an entire second, and to a maximum of 500 r.p.m. in throttling down.

On the other hand, the minimum time that must be taken for a determined reduction of the number of revolutions is as follows:

$$t = \frac{\Theta\omega_o}{M_o}\left(\frac{\omega_c}{\omega} - 1\right) = \frac{\eta}{30} \cdot \frac{\Theta\,n_o}{M_o}\left(\frac{n_o}{n} - 1\right) =$$

$$= \frac{n_o}{840}\left(\frac{n_o}{n} - 1\right) = \frac{10}{7}\left(\frac{1200}{n} - 1\right) \quad \ldots\ldots\ldots\ldots\ldots\ldots (6)$$

The results are shown in the following table:

For the reduction of the number of revolutions to n = 1100 1000 900 800 700 600 500 400 300 200 100 r.p.m. the minimum requisite

t = 0.13 0.29 0.48 0.71 1,02 1.43 2.00 2.86 4.29 7.15 15.7s.

It is *important* to know if such duration of time will be maintained in ordinary working when one of the cylinders does not work and when the engine is throttled down; in other words, if the retardation of the rotary parts of the engine and of the dynamometer is higher than as above calculated. If equation (1) be also applied to this crankshaft system with the smallest inertia moment, the propeller does not, in consequence, become free[2] so long as the rotary moment M_m of the engine fulfills the *condition* that

$$M_m > -M \cdot \frac{\Theta_m}{\Theta} \quad \ldots\ldots (7)$$

the retardation (which only occurs with negative M_m) of the parts of the engine being actually given by $\frac{M_m}{\Theta_m}$.

According to Hoff, however, Θ_m is 0.020 without the dynamometer, with the dynamometer, unfavorably calculated, 0.020 kgm./sec.^{2}, so that, therefore, the result must be that:

$$M_m > -M \cdot \frac{0.517}{0.026} = -\frac{1}{20} \cdot M \quad \ldots\ldots\ldots\ldots\ldots\ldots (7a)$$

that is, a *chance of pressure* up to—1/20 of the ordinary rotary moment and in the present instance up to $\frac{-45.6}{20} = -2.3$ kgm. may be assumed. This does not even occur in the case of the normal 4-cylinder engine in *ordinary working*,[2] far less in the 6- and 8-cylinder engines, in which the ratio of the masses is more favorably located.

If one of the cylinders should cease working, there is a strong variation of pressure in the 4-cylinder engine, less in the 6- and 8-cylinder, and none whatever in the 12-cylinder engine. In the first instance—which is certainly less important—there is no lifting in any case; in the modern 6- and 8-cylinder engines, on the other hand, it does not generally occur. This has also been proved by experience.

In throttling down strongly, however, such high suctional resistance may occur in all engines that lifting is unavoidable. In general, condition (7) is maintained. *Experiments* * made with the dynamometer hub also show that it does not usually derange the smooth running of the engine. It is only when there is rapid throttling that it flaps and in gliding flight with the engine stopped, when the propeller comes into resonance with the number of revolutions of the engine. With an ordinary number of revolutions, however, there is little risk of the rapid vibration of the propeller and crankshaft system and of the consequent critical number of revolutions, if the following conditions be observed:

The dynamometer is not only a *short circuit driving coupling,* but also an *elastic coupling.* It will, therefore, have more or less effect on the vibration according to the nature of the oil, of the tubular piping, etc. Shocks might actually, in one case,* be avoided by the installation of additional piping. The *danger of resonance* must, therefore, always be taken into consideration at the time of installation, as also in the case of engines constructed without a dynamometer.

SUMMARY: Every measuring device influences, by its own presence, the process that it is intended to measure. The function of the art of measuring is that of reducing such effect as far as possible.

This condition has been fulfilled by the dynamometer, at all events in ordinary working, because it leans on the needle of the capsule for rotary moment at the commencement of retardation until (in one case)

$$\frac{dn}{dt} = -\frac{M_o}{\Theta} \cdot \frac{30}{\eta} = -840 \text{ r.p.m./sec.} \quad (1a)$$

thus producing the flywheel effect of the ordinary fixed propeller.

In case of change of pressure, the negative rotary moments may (in one instance) increase up to 1/20 of the rotary moment of the propeller before the propeller becomes free. In the case of ordinary engines, this generally allows for the cessation of one cylinder without any lifting on the part of the propeller, and without depriving the engine of its flywheel.

[1] We shall not take into consideration the period during which the propeller becomes entirely free.

[2] Compare O. Winkler's "Entwerfen von leichten Benzinmotoren, insbesondere von Luftfahrzeugmotoren," Berlin W. 62, 1914, p. 82, etc. (Design of light gasoline engines, especially of Aeroplane Engines.)

* Compare O. Enoch's article in No. 19 of the "Zeitschrift für Flugtechnik und Motorluftschiffahrt."

SUNBEAM-COATALEN "COSSACK" ENGINE

When the Z.R.2 crosses the Atlantic it will be powered with Sunbeam-Coatalen engines.

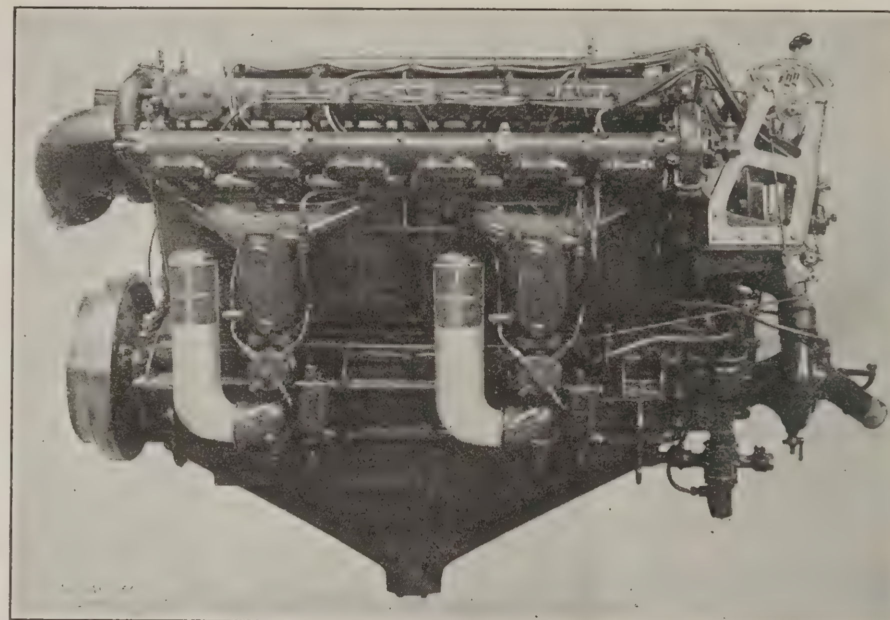
This type of engine has been specially designed for use in airships, and has 12 cylinders disposed in two rows of six each on the crankchamber in "V" formation at an angle of 60°. The cylinders are of cast iron in blocks of three and have two inlet and two exhaust valves operated by overhead camshafts, one to each set of valves. The camshafts are driven by trains of gears from the crankshaft, these also furnishing drives for the magnetos and other auxiliaries. The connecting rods are articulated and of "H" section. The pistons are of aluminium fitted with three compression rings and a scraper ring at the base. The crankcase is an aluminium casting in two portions, the division being at a point below the crank shaft level, which makes for greater rigidity and relieves the bolts of sheering stress. The crankshaft is a steel forging drilled throughout for lightness and oil circulation purposes, and has seven die cast white metal bearings.

Lubrication is on the "Dry base" principle, and is by gear wheel pumps, three pumps being fitted, namely, (1) the scavenger pump, which draws the oil from the sump and returns it to the oil tank, which must form an integral part of the installation. (2) The main force pump, which lubricates the main bearings with cooled oil direct from the oil tank. (3) The auxiliary oil circuit pump, which forms a portion of the main force pump and is arranged to deliver the necessary quantity of oil at a very low pressure to the camshaft bearings, and all auxiliary bearings of the engine.

Carburation is effected by four Claudel Hobson carburetors (C. Z. S. 42) of diffuser type arranged as standard and working under a head or pressure of 4 lbs. per square inch, the petrol feed being by pressure or by gravity. Various degrees of pressure can be obtained by altering the design of the float feed if necessary. Efficient flame baffles are fitted to the induction pipes.

Ignition is by means of four B. T. H. P. M. 6 magnetos furnishing independent sparks to two sparking plugs in each cylinder. These magnetos are driven by couplings formed of laminated spring blades which give great flexibility to the drive, and consequently greater life for the magento.

An ingenious type of governor is fitted which controls the speed of the engines by cutting off the ignition when the engine speed exceeds 2,500 r. p. m., and operates also in the event of the oil pressure falling below 25 lbs. per square inch.



The Sunbeam-Coatalen "Cossack"

The principal dimensions of the engine are as follows:

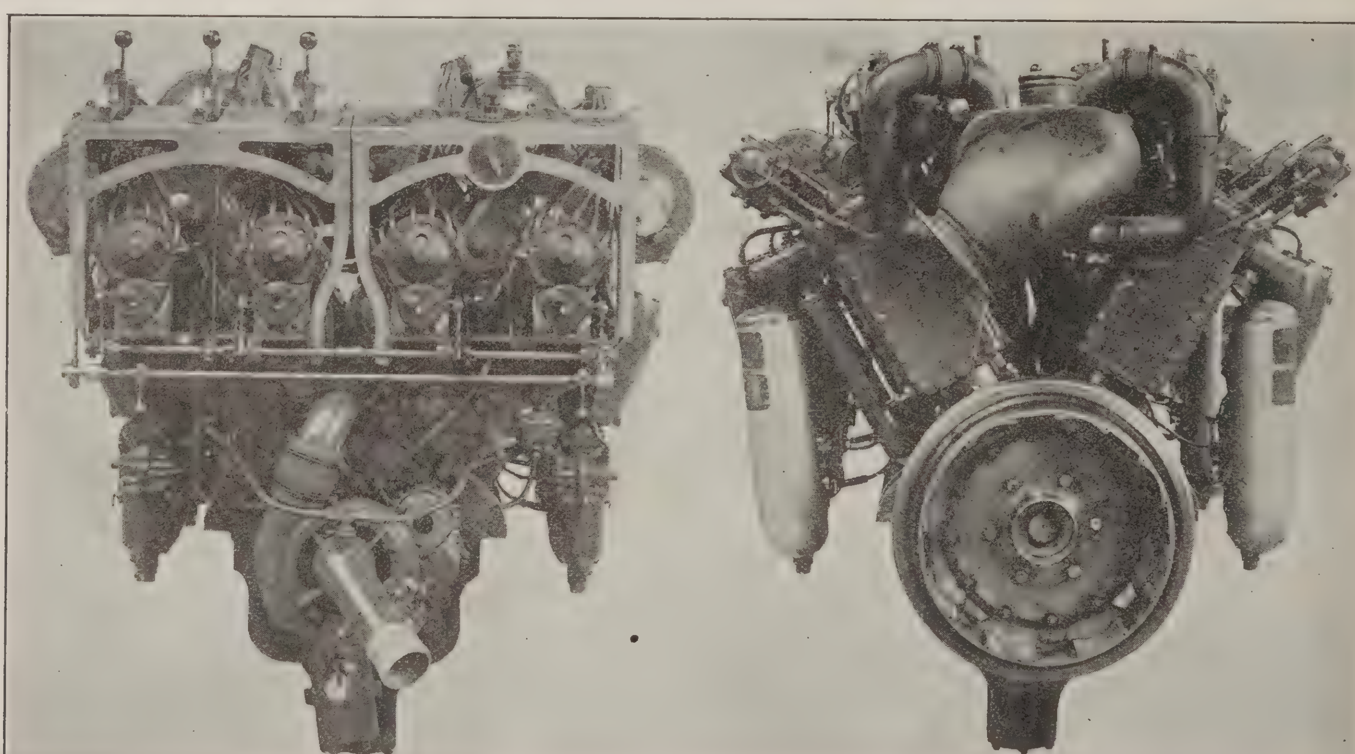
Bore of cylinders	110 m/m.	4.3 ins.
Stroke of cylinders	160 m/m.	6.23 ins.
Total stroke volume of cylinders	18.399 cu. cm,	11.22 cu. ins.
Area of one piston	96.035 sq. cm.	14.72 sq. ins.
Normal B. H. P. and speed	350 h. p. at 2000 R. P. M.	
Oil pressure	40 lbs. per sq. inch.	
Oil consumption	104 pint per B. H. P.	
Fuel consumption	.55 pint per B. H. P. hour	
Firing sequence	1, 1A, 5, 5A, 3, 3A, 6, 6A, 2, 2A, 4, 4A	
Direction of rotation of magnetos facing driving end of armature	2 clockwise and 2 anticlockwise	
Direction of rotation of revolution counter viewed from driving end of spindle	Anticlockwise	
Weight of engine and flywheel complete (without water, fuel or oil)	1200 lbs.	

One of these engines is disposed in each of the six cars of the airship, and the clutch, gear box, propeller, and, indeed the entire power plant has been constructed by the Sunbeam Motor Car Co. Ltd.

The gear box is similar in the two forward and two aft cars and operates to reduce the propeller speed to about one-third that of the crankshaft. A reversing gear is also incorporated in the two amidships cars, these being used for manœuvring purposes. In order to enable the engines to run disengaged from the propeller they are fitted with a flywheel and a multi-plate clutch.

A feature of these engines is that instead of the pull being on the car supports, it is transferred by means of a pull-wire directly on to the hull of the ship, thus relieving considerably the strain on the car mountings.

The propellers are of the pusher type, and each 18 feet in diameter.



Front and Rear Ends of the Sunbeam-Coatalen "Cossack" Engine

(*Concluded from page* 461)

miles southwest of League Island Navy Yard.

The flight of 120 miles from Philadelphia to Washington, with a passenger, proved to be more exciting and necessitated the use of all cloud-flying instruments.

The evening before the flight a start was made at 6:30 P. M. and after climbing to 1000 feet and being unable to see more than 2 miles distant in any direction and realizing that it would be dark by the time of arrival in Washington, due to weather conditions, we returned to the Field to wait until the following morning. If Washington could have safely been reached before dark, we would have gone on even though about 90 miles of the route would have had to be flown by compass, without any landmarks whatsoever until we got into clear weather around Washington, but again the route was new to me and landing after dark on a strange field, providing you find it, is not safety first, although I have done it safely.

At 6 A. M. the following morning the visibility was considerably worse. The haze had developed into a dense low-hanging fog and one could not see a distance of more than half a mile from the ground. At 10:15 A. M. after getting the weather report of clear at Washington, cloudy over Baltimore, and a ten-mile an hour wind from the southwest, which was my course, we took off.

The visibility was so poor that no time was lost in circling the field, so we headed for Washington regardless of thick or thin.

They told us that the mail pilots used to follow over the city, just under the clouds, following the railroad tracks. Probably that is the safest after all, if the weather conditions are about the same all along the route, because how is the pilot to judge accurately enough, above the clouds and fog, when he is over the right spot so as to come down and land. This is where the wireless direction finder will play the most important part in aerial navigation, but even now with the present instruments, one can quite safely come down through the clouds and fog to a safe landing on the specific field if he has already flown the course and checks it up with his compass, air-speed indicator and air-distance recorder, together with the wind direction and velocity.

At 1,000 feet a short distance from our starting point, the ground was lost to view as we climbed through the haze and into the clouds up to 3,000 feet. It is surprising how soon a machine begins to roll about in the clouds, like a cork on the ocean, when you lose sight of all landmarks and the horizon indefinitely, and when you do not rely on your cloud-finding instruments. I readily appreciated all instruments because of being tossed about and realizing that if the machine should be bumped into a steep nose-dive, side-slip, or a tail-spin I could do no better than come out dangerously close to the ground and possibly right above a built-up section of the country.

The high-grade reliable Pioneer Instruments, as illustrated, and reading from left to right, top row, are a banking indicator, altimeter, air-speed indicator, engine revolution counter and a turn indicator. Bottom row—an air distance recorder, oil temperature gauge, oil pressure gauge, dual ignition switch, carburetor choke-lever, altitude adjustment lever and a spark-retard lever. A compass was mounted, after this photograph was made, on the cowling behind the wind-shield, directly in front of pilot and passenger.

When flying in fog or clouds, or at night, the greatest difficulty is experienced in holding an aeroplane on a straight course. The compass is of little help, as its successful operation depends largely upon a straight course being maintained; and once a turn is started, throwing the compass off meridian, it offers no assistance whatever in regaining a desired heading. The turn-indicator is an instrument which will show when the plane is turning. By steering so as to prevent this instrument from indicating, a straight course can be maintained, the direction of which is given by the compass. Should a turn be started, its direction will be indicated and the plane can be quickly straightened out.

Next! the banking indicator which aids you in keeping your wings level laterally so you are not thrown into a side-slip,

The altimeter is of small value in helping you to keep the machine from nosing up into a dangerous stall, which would eventually result in falling off on one wing into a tail spin, or from nosing down into a steep nose-dive. The main instrument to prevent this is an air-speed indicator, which shows very quickly the decrease in speed if you are nosing up into a stall, or an increase in speed if nosing down into a nose-dive. The engine revolution counter acts practically the same. That is it decreases in revolutions per minute if climbing steeply, or increases in revolutions per minute if nosing down.

The use of a reliable air-speed indicator gives a machine a safety factor which cannot be obtained by any constructional feature. Every aeroplane has a safe flying range, whose lower extreme approaches a stalling point and whose higher extreme nears the condition of a dangerous steep dive. Between these two extremes the aeroplane may be flown with safety. For best economy the speed should be about halfway between the extremes. For best climb, and for making the greatest possible distance with least power, it should be near the lower extreme. For greatest possible speed with full power it should approach the maximum. No pilot is clever enough to keep his machine at the proper speed at all times without the aid of an air-speed indicator. It assures minimum landing speed with safety, maximum high speed, maximum climb—in fact, maximum performance in every way.

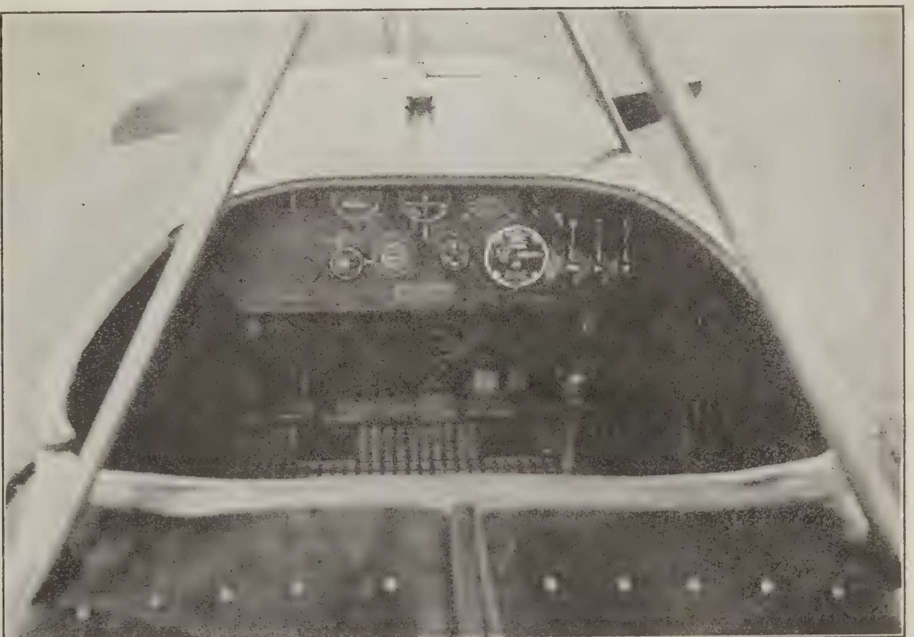
In cross-country flying one of the most necessary items of information is the distance traveled, particularly when flying in bad weather or over unfamiliar territory. The air-distance recorder is valuable and necessary in showing the distance traveled. It eliminates much of the uncertainty, and making allowance for the wind, one can be sure of arriving very close to his destination; and especially if in or above the clouds, it helps one to determine when and where to come down.

From Philadelphia to beyond Baltimore, a distance of 110 miles was flown entirely by the above mentioned instruments. Being assured against turning by the turn-indicator, it was easy to follow my compass course and the banking indicator, together with the air-speed indicator assured a perfectly level flying position, regardless of being tossed about by the bumps and not being able to see further than the wing tips of my machine.

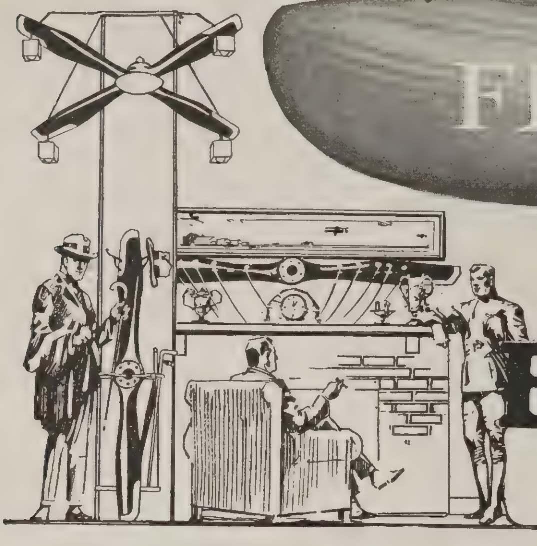
The engine throttle was set at 1680 R. P. M. for an economical cruising speed of 70 miles per hour into a 10-mile an hour head wind, holding our altitude at 3,000 feet through heavy clouds, and the heavy mist which obscured the sun.

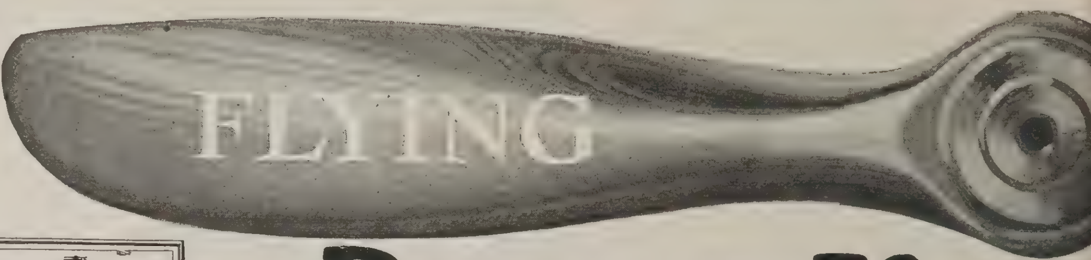
My youthful passenger, one of Philadelphia's future great aviators, I say this because of his enthusiasm for flying, was a great aid to me in occasionally checking up our course, as from his side of the machine through the breaks in the clouds he kept an eye on the B. & O. Railroad tracks, and from my side I kept an eye on the Pensy tracks. We could check up our course by towns according to the air distance traveled. At Baltimore we had to climb to 4,000 feet to avoid huge dense black clouds, yet the thick haze above us obscured the sun from our view. At no time was the sun visible to us. Ten miles further on the haze had dissipated and the clouds were fast breaking up and we were above Washington almost before we realized it, so in a few minutes we were descending through the heat bumps and approaching for a landing on Bolling Field.

Flying through the clouds in the BaCo "Skylark" is less strenous on the pilot than in other machines, because it is equipped with an air-cooled Radical Engine. This eliminates the necessity of operating a hand gasoline pressure pump and radiator shutter or watching a water temperature gauge and a gasoline pressure gauge as the fuel system is of gravity feed.



The Instrument Board of the BaCo Skylark





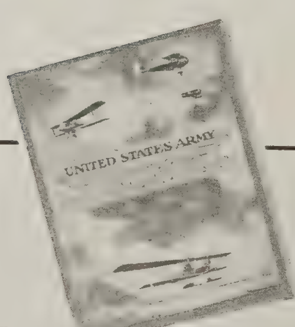
Decorate Your
Emblem of the Profe

HARDLY a club, regardless of its character, but can use this symbol of the Flying Corps. Its outstanding feature as a decoration is not as an ornament, but as a useful bit of equipment.

Pipe racks, hat and umbrella stands, chandeliers, are all within this scope of useful conversion and at a small cost. As a matter of fact any chap at all handy with tools and a taste for mechanics can, in his spare moments turn out a creditable, useful decoration from one or more of these propellers.

Just think of it—these blades can be bought at from two to eighteen dollars; two, three and four bladed types, and perhaps the very type that you or some member of your club has flown with.

Many clubs in all parts of the world have purchased propellers and used them as suggested, to excellent advantage and satisfaction. Now comes your chance; get together; buy one or more, or as many as you might need. It is not likely that there will ever be another opportunity at the prices quoted.



Prompt Action Is Earnestly Advised

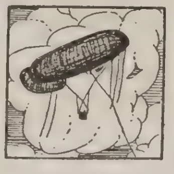
Write for the Descriptive Catalog.

Complete detailed descriptions of all materials offered, together with prices and terms of sale, are given in an illustrated catalog which will be sent to any person on request. WRITE FOR YOUR COPY TODAY.

Sale of

UNITED

SURPLUS AERON



FOREIGN TECHNICAL DIGEST

Schutte-Lanz Rigid Airship Construction

A long and interesting description of an airship built for the German navy by the Schutte-Lanz firm of Mannheim during the war. The article treats the construction of the vessels in great detail, and is illustrated by several very good photographs taken during construction, and by drawings. In general arrangement, the airship is very similar to the later Zeppelins, the essential difference being that the construction is of wood. The main rings are triangular in section, built up of three flat strips of laminated spruce, with lightening holes, stiffened internally at short intervals. The auxiliary rings are in the form of flat Warren girders. The woodwork is protected by a special varnish evolved by the constructors, and photographs are given illustrating tests on its waterproof qualities. The five 240 h.p. Maybach engines are carried one in a forward gondola, one each in two wing gondolas, and two in a larger gondola in the rear, all driving airscrews at the rear of the nacelles through short lengths of shafting. The control car is entirely separate from the forward engine gondola, and some little distance in front of it. The petrol is carried partly in gravity tanks, two for each engine, which are slung by wires between the upper joints of the triangular internal keel, and partly in a series of smaller tanks fitted with quick-release devices to enable the petrol to be dropped in case of emergency. The water ballast, in a similar manner, is carried in large containers made of rubber-proofed fabric, slung from the keel girders, and also in a series of smaller tanks, supported at the bottom of the main rings, with quick-release valves, to assist in manœuvring the ship on landing. The cubic capacity of the ship is 1,977,000 cubic feet, its useful load 37 tons, and its top speed 62 m.p.h. A photograph is given of the original Schutte-Lanz airship SL2, built in 1913, from which the ship described was developed. The design of this early vessel appears in many ways to have been some years in advance of those of other firms, having a very good streamline form, simple cruciform tail, direct driven airscrews, internal keel, and other points which have only comparatively recently been generally accepted. The Schutte-Lanz firm is understood to have constructed later airships in duralumin, the form of construction being mainly tubular. (*"Zeitschrift für Flugtechnik u. Motorluftschiffahrt," April* 30, 1921.)

Comparative Study of the Efficiency of Various Dirigibles

A table is given of the principal dimensions of various French non-rigid and German rigid airships, including columns comparing their aerodynamic and commercial qualities. The figure of merit chosen for the aerodynamic comparison is the ratio of the mechanical efficiency of the power group (including airscrews) to the drag coefficient of the airship. The rapid improvement in the Zeppelin airships from type to type is very marked, and the reasons for this are apparent from a glance at the outline drawings given of the various types. The non-rigids do not show such large differences: the early types were initially of better form than contemporary rigids, but the scope for detail improvement is very limited. For the commercial comparison the ratio taken is that of useful load/total weight. While these figures are not without interest, they do not form a basis of direct comparison, as they are fundamentally dependent on the size of the airship. One would like to have seen the various British rigid and non-rigid airships included in the survey. The article is illustrated by photographs of various types.

(*L'Aeronautique May*, 1921)

Aeronautical Maps.

Since the Armistice really wonderful strides have been made in the world of aviation—one hears on all sides of new routes being inaugurated almost each week for the carriage of passengers and goods by air, of reductions in fares and freight charges, and even the compilation of an "Aerial Bradshaw." In sipte of this record of progress, however, very little attention appears to have been paid to the subject of special maps for aviators. Perhaps it will be urged that such maps are at present unnecessary, on the plea that pilots of machines on such routes as London-Paris are so used to the journey that they can find their way without the need of a map of any kind. No doubt this contention is perfectly reasonable, but but one must not lose sight of the fact that there are already in operation routes considerably longer than London-Paris; for example, Paris is now aerially linked with Warsaw, a distance of about a thousand miles. Also there is a growing demand for the aerial taxi; business men and others who value their time are becoming more and more frequent in their use of this form of locomotion, and pilots must now be prepared to fly to any place off the beaten track of regular air services.

The only maps at present available are those prepared by the Ordnance Survey Department and special motoring and road maps. These are no doubt excellent in themselves and ably serve the purposes for which they are intended, but they do not conform to the aviator's requirements. During the war the difficulty experienced in using maps of the kind mentioned was that too much detail was shown in the way of contours and colors (where the layer system of indicating heights was adopted), also such features as bench marks, heights above sea-level, county and parish boundaries, and so on. In a country such as Great Britain, where the highest peak is less than 4,500 ft. the airman does not need to concern himself with the contours of the ground except during fog and mist. From a height of about 3,000 ft. all minor undulations disappear and the country appears flat.

In any map the first point for consideration is the scale: in an aeronautical map this is especially so, since from a height of ten to twelve thousand feet one can see (on a clear day) a distance of about fifty miles in every direction; also it must be remembered that in the air distances are very quickly covered and a pilot does not want to be continually altering his map. For short cross-country flights a scale of 1:250,000 might be found suitable. On a map of this scale it would be possible to show the exact position of landing grounds. For the average flight, however, especially on the Continent, 1:500,000 is suggested. This represents approximately eight miles to one inch and a large tract of country can be depicted on a conveniently sized sheet. With this scale the whole of the area covered by the Aerial Trunk Routes formulated on May 1, 1920 (embracing England, Wales, Scotland, as far north as Edinburgh, and the east coast of Ireland), could be shown on a map of four sheets, each being 2 ft. square. These sheets could be folded into four—a foot square being quite a conveniently sized map board to manipulate in the rather confined space of a pilot's cockpit. If the map were exhibited on a roller it would be possible to show a strip of country eighty miles wide on a ten-inch roller.

The next point to be considered is the question of the landmarks which stand out most conspicuously from the air and how they can be most clearly reproduced on a map. In England the best guides are undoubtedly the railways, and bridges carrying railways over roads and *vice versa* should also be marked; in this connection one might add that viaducts show up very well (these are more numerous on the Continent than in England). It is hoped that the practice of painting in large letters the names on the roofs of railway stations will be more universally adopted. Tunnels should in all cases be indicated.

In the same category as railways may be included roads, especially in France and Belgium, where they stretch dead straight for distances of twenty miles at times, being found of great assistance during the war.

Of equally great importance is the presence of water—rivers, canals, lakes and reservoirs—especially at night. It is common knowledge that enemy aircraft raiding these shores during darkness always relied almost entirely on our rivers to give them their direction. Reservoirs and canals are of particular use owing to their usually regular shape and straight course respectively.

Woods and orchards also provide very good landmarks for the aviator; by noting the peculiar shape of a wood seen below when emerging from clouds a pilot can often pick up his position immediately. *En passant*, however, it may be observed that it is not so much individual landmarks that enable a pilot to find his way as their interrelationship. There may be, for example, two or three places where a railway crosses a road near a fork, but the presence of some other feature will at once serve to distinguish one from another. In open country village churches are often of great use in this respect.

In order to conform to natural colors it is suggested that roads should be represented in brown, railways black, water blue, and woods green. Churches should be indicated by crosses and other features by conventional signs.

As to the preparation of maps conforming to the ideas enumerated above, the Ordnance Survey might be taken as a basis. Maps made from air photographs have been found impracticable for cross-country flying, owing to the scale being too large; but air-photographs would prove of great value in the actual making of the maps, as they would help in deciding what landmarks might be added or omitted.—*Aeronautics, June* 9, 1921.

NAVAL and MILITARY AERONAUTICS

Ambulance Plane Fall Found Due to Weather

Washington—Lack of adequate information as to weather conditions and no fault of plane or pilot are held responsible by the Inspector General of the Army, after investigation, for the accident to the Curtiss Eagle army ambulance plane recently at Morgantown, Md., in a thunderstorm, and the death of all seven men aboard the craft.

"It is highly desirable," said the special report to Secretary Weeks made public July 13, "that an order should be issued that in peace times, except in emergencies, no cross country flights should be undertaken until available information of conditions on the way has been obtained."

The report stated that all witnesses who testified before the investigating board agreed that the accident was due to the severity of the storm encountered near Morgantown.

"It is almost certain that lightning played no part in the accident," the report says, adding that a treacherous air current undoubtedly caused the plane to fall into a vertical nose dive.

Commenting on the structural qualities of the craft, the report stated that, judged from the testimony of pilots who had actually handled it and other planes of similar make, "it possessed great ease of control for a plane of large size, a very satisfactory manoeuvering ability and a capacity for carrying heavy loads.

"The removal of the litters did not affect the stability of the plane," the report said, "although the method of carrying the passengers during the flight may have introduced an element of danger. It has not been developed that the Curtiss Eagle plane is unsuited for military service, but there is a doubt as to whether it possesses sufficient power for a bombing plane."

The report completely absolved Lieutenant Stanley Ames, pilot of the machine, from blame. He is praised as having been a trained, cool flyer, with a "thorough understanding of planes and motors" who could "always be depended upon in an emergency."

Establishment of a system for interchange between aviation fields of information as to weather conditions is recommended.

Jury Clears Air Pilot

Moundsville, W. Va.—Lieutenant C. R. MacIver, pilot of the aeroplane which crashed into a crowd at Langin Field, killing five persons and injuring a number of others, was exonerated from all blame by a Coroner's jury. The jury held that the accident was unavoidable.

Lieutenant MacIver and Lieutenant D. H. Dunton, pilots of the plane, told the Coroner's jury that they did not know what caused the accident. MacIver told the jury that he thought the plane fell because of a "frozen wheel." Dunton testified that MacIver made every effort to avoid the accident.

H. L. Lambert, an official of an aircraft company, and K. J. Dooley, one of his pilots, told the jury that the catastrophe could have been avoided by veering the plane toward the river.

Clear Canada Trip of Naval Balloon

Washington—The romantic story of last December, when a naval balloon left Rockaway, Long Island, carrying three naval aeronauts, who subsequently landed in snow-covered wastes in the Canadian forests, and reached safety only after hardships which so affected their nerves that two of them engaged in fisticuffs, ended July 13, when a court of inquiry made its report.

In this document, made public by Secretary Denby, the court, headed by Rear Admiral George W. Kline, U. S. N., does not censure the three airmen, Lieutenant Louis A. Kloor, Lieutenant Stephen A. Farrell and Lieutenant Walter T. Hinton, for making the flight, but instead says that the journey was authorized by the commanding officer, although crossing the Canadian border was never contemplated.

Of the sensational encounter between Farrel and Hinton, the findings of the court say:

"The conduct of personnel was creditable throughout the flight and subsequent journey to Moose Factory and from Moose Factory to Mattice, Ont. A spirit of cooperation and mutual assistance was shown in overcoming hardships and sufferings incident to their landing in a barren, unknown and inaccessible country in the heart of winter.

"Shortly after arrival at Mattice, Ont., a personal altercation between Lieutenants Farrell and Hinton took place, in which Lieutenant Hinton was struck by Lieutenant Farrell. Lieutenant Farrell at this time was in a highly excited, nervous and exhausted condition, due to exposure.

"This difference was later adjusted in a manly way by giving and accepting of an apology, re-establishing the friendly relations which had previously existed."

The main findings tell of the flight of the balloon from the time it left Rockaway, on December 13, until it came down next day, and until the three weary men reached Mattice, January 11, and eventually New York, January 14.

The report then continues:

"The purpose of the flight was the training of personnel, the plan and intention being to carry out a routine flight continuing during the night if conditions proved favorable. The crossing of the international frontier was not contemplated by any one connected with the flight or the authorization of same. Orders for this flight were issued by the commanding officer of the air station as part of his duties in connection with carrying out the training syllabus issued by the department for the training of naval aviators.

"The balloon was properly prepared and inspected before the flight. All necessary instruments were carried and the crew was properly equipped. The allowance of charts carried was meagre and should have included a general map of Canada, as the wind direction indicated a flight toward the border. The provisions carried were sufficient for twenty-four hours, which was beyond the contemplated time of flight. No emergency rations were carried. No balloon log was carried.

"All meteorological data had been procured prior to the flight that was practicable to obtain, through the agency of the air station Aerologist and the office of the Weather Bureau in New York City. Three reports indicated favorable condition for a free balloon flight with winds of approximately 18 miles per hour from the south at an altitude of 2,000 feet, with possibly increasing force during the night.

"Under these circumstances the authorization for the flight was justified by the facts obtainable, but the pilot should have been given more definite instructions as to the extent of the flight. The balloonists had no means of determining meteorological data from outside sources, subsequent to departure from the air station at Rockaway Beach.

"The balloon was adequately equipped and had sufficient provisions at the time the flight commenced and immediately anterior to that time had the flight been carried out as contemplated.

"It is the general opinion of the officers who were connected with this flight that the naval operations order defining different types of flights is not applicable to free balloons. The commanding officer was perfectly cognizant of this order, but did not consider that it applied to free balloons.

"The Executive Officer, Lieut. Commander A. H. Douglas, U. S. N., has not attended the sessions of the court, owing to detachment and present duty on the Pacific Coast. Lieutenant A. D. Brewer, U. S. N. R. F. 5, in charge of the lighter-than-air division, considers that for other than local flights he should obtain authority from the commanding officer.

"The pilot and passengers in the balloon considered that their orders contained the necessary authority for the contemplated flight. They were not familiar with the order of the Chief of Naval Operations of October 11, 1920, in regard to permission necessary to be secured in order to authorize other than local flights."

Major Wheeler Killed

Honolulu, T. H.—Major Sheldon H. Wheeler, Commandant of Duke Field, the army air base here, and Sergeant Thomas A. Kelley, were killed, July 13, when their plane fell, after taking off for a practice flight.

The gasoline tank exploded, covering the men with burning oil. Major Wheeler's home was in Burlington, Vt.

FOREIGN NEWS

The British Society of Architects and Aeronautical Architecture

It is of considerable interest to note that British architects are now considering seriously the problems of aeronautical architecture. Hitherto aeronautical buildings of all kinds, including the Air Ministry itself, have merely happened, that is to say they are merely buildings constructed to house certain people or certain products, and have never apparently been designed with any idea of beautifying the landscape.

It is only in Germany where airship sheds have been designed by real live architects with the result that some German airship sheds, at any rate, have the majesty of an Assyrian temple.

Now, however, the students of the atelier, which is conducted so ably by Monsieur Chaurés on behalf of the Society of Architects at 28 Bedford Square, W.C.1, have for the first time taken aeronautical buildings as a subject of their study. Last week a private exhibition was held of the drawings produced for the monthly design competition of the atelier, the subject being the lay-out of a Centre of Scientific Research including aeroplane and airship sheds, workshops, laboratories, administrative offices and lecture halls for experimental and educational work in connection with aircraft.

Though one refers to the producers of these designs as students, they are in fact the coming men of the architectural profession who band themselves together in the atelier for mutual assistance, criticism and competition. Monsieur Chaurés himself is the winner of the French Prix-de-Rome, and recently won a competition for the lay-out of the Paris fortifications, and the members include winners of the British-Rome prize, the Society of Architects' "Victory Scholarship," the Tite prize, etc., and several big public competitions.

It is therefore eminently satisfactory that men of such quality should interest themselves in aeronautical architecture, for with the growth of civil aviation it will become necessary to design the buildings of air ports on an adequate scale. It is to be hoped that then such buildings may be designed by clever architects, and that the designing will be done not only with due regard to the elevations of the buildings, but also to beautifying their plan views, which in the circumstances will be even more important than their elevations.

The Zeppelin Aerodynamical Laboratory

At the Friedrichshafen works of the Zeppelin Company there has been installed an aerodynamical laboratory which includes among its equipment what is claimed to be the largest wind tunnel in the world.

The tunnel has been designed by and constructed under the supervision of Dr. M. Munk, who was for long associated with the Göttingen Laboratory, and it resembles the installation at Göttingen in many respects.

As in the majority of European installations, the tunnel is generally of the type used by M. Eiffel. That is to say, that instead of enclosing the model within a tunnel of parallel section as at the N.P.L., the models are in a large open room through which a parallel stream of air is passed.

The general arrangement of this tunnel is shown in the sketches here reproduced. The whole structure is built in concrete except for the exhaust cone, and constitutes a closed air system, the experimental chamber, inlet and exhaust cones, and the airscrew being on the center line, with twin air return passages at each side.

The motive power of this installation consists of two 260-h.p. Maybach engines, coupled in tandem, driving through a reduction gear an airscrew 5 meters in diameter. The diameter of the airstream at the experimental chamber is 2.9 meters and the maximum air speed is 50 meters per second.

The whole of the measuring instruments are carried above the stream on a steel platform. An interesting feature of the balance used for measuring forces is that it is largely built up of duralumin girder work similar to that used on airship frames. Thus the weight of moving parts is kept down to the lowest possible limit.

Models are suspended by wires from two overhead bridges, one fixed permanently and the other movable, both horizontally and vertically. Movement of this bridge effects alterations in the incidence, etc., of the model.

British Seaplane Races

The Royal Aero Club have organized two seaplane races to be held on August 1st and 2nd, during the Cowes Yachting Week.

These races are to be known as the Isle of Wight Handicap, and the Solent Handicap, and are open to persons of any nationality holding a license issued by any Aero Club affiliated with the F.A.I.

The Isle of Wight Handicap, to be held on August 1st, will be for a Trophy of the value of £100, presented by Lieut-Col. F. K. McClean, and £250 presented by the Royal Aero Club. The course, of approximately 80 miles, will be from a point off Cowes to Ventnor, out and back twice, passing Ryde, Sea View and Foreland.

The Solent Handicap, to be held on August 2nd, will be for a prize of £250, presented by the Royal Aero Club. The course, of approximately 80 miles, will be over a circuit of 20 nautical miles, situated on the Solent, to be covered four times. The circuit will include a point off Cowes, No Man's Fort, Horse Sand Fort and Spitbank Fort.

Competitors will be started on the water at intervals according to the handicap, and the winner will be the competitor who having properly completed the course first crosses the finishing line in flight. Alighting, replenishments and repairs will be permitted *en route*.

In order to get over the difficulty of seaplane manufacturers being short of pilots, it has been reported that the Air Ministry will permit Service pilots to compete.

A New French Concern

The following is a translation of a note taken from one of the French newspapers:

French Aviation Consortium.—The object of this limited company is the study of trade and industry concerning aviation, automobiles, and mechanics in general.

The office is in Paris, 2, Rue Galilée. The capital of 120,000 francs will be subscribed, all in cash, by shares of 1,000 francs each.

The first directors are: Mr. Louis Blériot, manufacturer at Suresne (Seine), 3, Quai du General Gallieni; Mr. René Caudron, manufacturer, at Issy-les-Moulineaux (Seine), 52, Rue Guynemer; the Société des Aéroplanes Morane Saulnier, at Puteaux (Seine), 3, Rue Volta; the Société des Ateliers d'Aviation Louis Bréguet, at Paris, 115, Rue de la Pompe; the Société des Automobiles Hispano-Suiza, at Bois-Colombes (Seine), Rue du Capitaine Guynemer; the Société des Etablissements Nieuport, at Issy-les-Moulineaux (Seine), Boulevard Gallieni, 46; the Société Henri et Maurice Farman, at Billancourt (Seine), 167, Rue de Silly; the Société Lorraine des Anciens Etablissements de Dietrich et Cie. de Luneville, at Paris, 125, Avenue des Champs Elysées; the Société des Moteurs Gnôme and Rhône, Paris, 41, Rue de la Boétie.

Aviation in Japan

An exhibition of German war aircraft was given to journalists and others interested at the Japanese Army Aerodrome at Tokorozawa on April 21st. Twenty-four types, all of the latest period of the war, were shown, together with some twenty specimens of German engines.

It is reported that the Mosubishi Dockyard Co. Ltd. has bought a tract of land near the Army aerodrome at Kagamigahara, and intend to establish aircraft works thereon. The Kawasaki Dockyard Co. Ltd. of Kobe are also proposing to establish an aeroplane factory in the same neighborhood.

Mr. C. Itoh, of the Itoh Aeroplane Works and Flying School, Mr. C. Nakajima, of the Japan Aeroplane Works Co., Mr. E. Shirato, of the Shiratoh Flying School, and Mr. C. Inagaki, engineer to the Itoh Aeroplane Works, have each been awarded sums of from yen 3,000 to yen 2,000, given by the Flight Bureau, in recognition of their services in the development of aviation in Japan.

New Gasoline Substitute

According to South African journals, a new gasoline substitute, known as Penrol, invented by a Mr. Penhale, and produced entirely from South African products, has been tested on an aero engine by Captain Ross of the Ross-Thompson Aviation Co. Ltd.

The tests were made at Baragwanath Aerodrome, 5,700 ft. above sea level, and the machine used wat a 110-h.p. Le Rhône "Avro." It is stated that the engine started easily, kept remarkably cool, and developed ample power.

Penrol is reported to be an alcohol-acetylene combination.

The N.P.L. Report

The 1920 Report of the National Physical Laboratory has just been issued. Of the 132 pages of this book five are devoted to the work of the Aerodynamics Department. This information is enlarged upon in the reports of the Aeronautical Research Committee. Possibly the most interesting work referred to in the present book is that on new wing sections, which has been limited to the testing of a few special aerofoils for the Air Ministry and for private firms, whilst a model of the Fokker biplane is now being made in order that the possibilities of wing sections which are sufficiently thick to require no external bracing may be thoroughly investigated. Another interesting note refers to the decision of the Air Ministry that models shall be made of all experimental aeroplanes likely to be put into production and these models tested at the laboratory. So far, six models have been received, but none of them are machines at present being used commercially or to any great extent in the R. A. F. The principal research of the year has been the measurement of pressure distribution for the entire surface of a rotating airscrew blade. Airships have also received attention, experiments having been carried out in connection with the problems of towing and mooring airships and also to determine the balancing area required for the control surfaces of R38. Reports on the trials of R33, R26, and R29 have also been prepared, and it is interesting to notice that the petrol consumption of R33 at the full speed of 60 m.p.h. was about 1¼ gallons per mile. Work is also being carried out with regard to experiments on aeroplane carrier ships, parachutes and fluid motion.

Inspecting Queensland Sheep by Aeroplane

A Victorian dealer recently took a long journey north to view 25,000 Wether sheep that were feeding on the Moscow pastures, near Winton, but heavy rains had been falling, and beyond a certain point the roads were impassable and the rivers flooded. Keen on his purchase, the dealer hired an aeroplane from the Queensland and Northern Territory Aerial Services, Limited, and viewed the whole flock from the air, occasionally landing on elevated ground to inspect the sheep in more detail. The adventure ended in the purchase of 25,000 sheep to the satisfaction of all parties concerned.

R36 Damaged

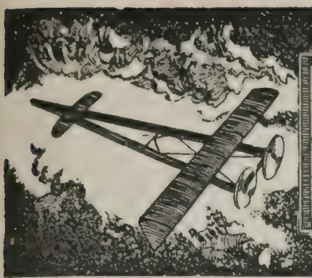
When R36 was mooring to her mast at Pulham after a flight last week, the wind carried the ship over the top of the mooring mast, and the cable which was attached strained and slightly damaged the fore part of the ship, necessitating her being taken into the hangar. As the airship was being drawn into the shed the fore part caught the inside of the shed, and was still further damaged. Repairs to the R36 will take a very short time. Two men were injured in getting R36 to the ground after her bows had snapped one of the steel stays of the mooring mast.

Paris Aero Salon

Further particulars of the French Aero Salon, November 12-27, are now available. Broadly the general regulations are the same as in 1919, but the charge for space has been considerably reduced, and at the present exchange value may tempt some of our firms to be represented. Central positions of 140 sq. metres are this year 12,000 frcs., second positions 9,000 frcs., and third positions 4,000 frcs., instead of 16,000, 12,000 and 5,000 frcs., respectively. Exhibitors this year must not stage or advertise other firms' productions, but air navigation companies may be represented in the construction of their machines. Prices of admission at 5 frcs. on the opening day and every Friday, and 2 frcs. on every other day remain as before, but any profits in the show will be divided as to half for aeronautic works and half to the exhibitors.

The classification embraces: (1) Balloons, (2) heavier-than-air machines, (3) motors and propellers, (4) aerial navigation, (5) motor boats, (6) machine tools and raw materials, (7) transport and sheds, (8) allied industries, (9) commerce, (10) science and art, and (11) maps and books.

M. Leblanc is the President, M. Granet, Secretary-General, and the Executive Committee comprises MM. Bréguet, Chauviere, Delage, Kapferer, Lioré, Luguet de Saint-Germain and Mallet. Space can be now applied for and other particulars obtained from the Commissariat-General, 9, Rue Anatole-de-la-Forge, Paris. Applications close September 1.



ELEMENTARY AERONAUTICS and MODEL NOTES

Mummert Biplane Tested Successfully

The small sport biplane, designed and built by Mr. H. C. Mummert, which was described in the columns of the Elementary Aeronautics page last week, has been successfully flown at the Curtiss Flying Field near Mineola. The tests were conducted by Bert Acosta, the veteran test pilot, whose record for variety in the types of machines he has flown would be difficult to surpass. Incidentally it might be remarked in passing that during the same afternoon Acosta flew the giant Remington-Burnelli biplane which carries thirty passengers.

In preparing for the flight, a humorous incident occurred which emphasized the compactness of the sport-plane's fuselage—Acosta found it necessary to remove his shoes in order to reach the rudder-bar. This was made necessary because of the small holes provided in the bulkhead through which the pilot must put his feet to operate the rudder-bar. In spite of this, the pilot was able to handle the machine with the greatest of ease and comfort.

On the first flight the pilot held the machine on the ground for an initial run of about 200 feet before taking off. The length of the run could have been shortened but the safest way on such occasions is to take off at a very low angle so that the highest possible speed can be attained on the ground before raising the elevators and taking to the air. When the machine got off the ground it was observed to be flying very steadily and with even greater speed than its theoretical performances indicated. It was believed that a high speed of ninety miles an hour could be obtained, but the pilot and witnesses on the ground who compared the speed to well-known machines flying in the vicinity, estimated the speed to be nearly 100 miles an hour.

The critical test came when Acosta put the machine into an "Immelmann turn," which, as many of our readers know, is accomplished by first going into a loop, but when the top of the loop is reached the machine is suddenly flipped sidewise into normal flying position. The little machine went through this maneuver, as well as many others, with a very fine showing. As to be expected with machines having two-cylinder opposed engines, a good deal of vibration was noted, but was not considered excessive. During the tests the engine was turning up fifteen hundred revolutions per minute and was not run above that speed, although capable of turning at two thousand. An important observation was made which will change some notions regarding misfiring in a two-cylinder opposed engine. The common supposition is that in the case of a small plane so equipped the first sign of trouble in one cylinder would so reduce the power as to make an immediate landing necessary. Contrary to this opinion, it was found that upon an occasion when one of the cylinders continually misfired, the loss of power was so small as to be barely noticeable from the ground and the only apparent result was a loss of forward speed, but at all times the machine was under perfect control.

After fifteen continuous minutes of flying, during which time an altitude of 1,500 feet was reached, the pilot landed with the same ease with which he lands a high-powered machine. His comment on the performance of the engine and the machine's behavior in the air was extremely favorable. Inasmuch as Mr. Acosta's opinion on new ships is regarded so highly, his comment that "the machine has absolutely no 'tricks' and needs very few minor adjustments," speaks very well for the result of Mr. Mummert's solution of the light plane problem.

Initial Meeting of West Texas Model Club

A meeting is soon to be held under the direction of Mr. Starkey Duncan of Stamford, Texas, where all the young men of Stamford who are interested in model aeroplanes will be called together for the purpose of organizing a club and electing officers. Mr. Duncan, although a recent enthusiast at model building, has been interested in aviation for several years. He has lately completed a JN-4B model and is now building a racing model which was described in AERIAL AGE some time ago.

It is probable that Mr. Rupert Sims of Santa Anna, Cal., who has offered his assistance to Mr. Duncan, will organize an auxiliary club in his town.

Good Flights Made With Hydroaeroplane Model

A hydroaeroplane flying model, built to the plans of Mr. W. F. Schult, which were reproduced in the February 21 issue of AERIAL AGE, made several pretty flights on "Baisley's Lake," Jamaica Park, Long Island. The location proved to be ideal for this sport as there is a wide stretch of water protected by trees all around. It is possible to hire boats on this lake, which is owned by the Department of Parks, Borough of Queens. The spectators on the shore were greatly interested in the remarkable flights made and several of the boys in the neighborhood immediately contracted the desire to build models for themselves.

The model has a wing span of 18⅜ inches and weighs less than 2¾ ounces. It is provided with a central main pontoon 15⅜ inches long. Twenty-four feet of rubber elastic are used.

There was but little wind blowing at the time and the machine skimmed on the water for about twenty-five feet before leaving the surface. As soon as the floats left the water the model climbed very rapidly to a height of about thirty feet, remaining at that altitude until the power gave out, when the machine went into an easy glide. Although very unusual for hydro models, each time the machine alighted it balanced evenly on the floats and remained right side up. About ten flights were made and in each case the machine balanced perfectly and landed in the same manner.

It was decided that improvements could be made by building a main wing frame of lighter construction and that balance on the water could be assisted by spreading the two small auxiliary floats slightly further apart.

Mr. Schult and one of his companions intend to build some slightly larger hydro models of rather conventional design which will be tested on the lake soon.

The H. C. Mummert 25 H.P. Sportplane which makes a speed of 100 m.p.h.

"I Wonder If He Will Miss Me," sang the young lady with the cracked voice. And from the balcony came the answer, "If he does he ought never to be trusted with a gun."

—*Siren.*

We roll out our "bus,"
To take off and go high.
The people are afraid of us,
For when we take them up, they all sigh.

The prop turns at R.P.M.,
When the O. X. is a huming.
They say we may loose a limb,
When we go up for a bombing.

R. S.

We fly and fly over country unknown,
You fly and fly like the birds of the air.
They fly and fly over towns and cities,
But, we can't fly to Mars.

R. S.

Mick: Pat, what is your idea of useless effort?
Pat: Aw, sur'n it is marking time, friend.

—*American Legion Weekly.*

He—I stopped a terrible fight yesterday.
She—You hero—how did you do it?
He—I kept well in the lead.

Practically Fatal

O'Toole: They do be sayin' this here game o' golluf be healthy.

O'Phule: Healthy, is it? Sure, how can it be when the players end up wit' a stroke?—*American Legion Weekly.*

Oh, Heavens, No!

She had accepted his embraces without reserve, but every time she seemed to be on the verge of going to sleep. It was most exasperating. Finally he remonstrated.

"See here," he demanded peevishly, "Why do you always appear asleep when I kiss you?"

"Why, Harry," she retorted indignantly, "you don't for a minute think I'm the sort of girl who would do such things with my eyes open!"

Where can a man buy a cap for his knee
Or a key to a lock of his hair?
Can his eye be called an academy
Because there are pupils there?
In the crown of his head what jewels are found?
Who travels the bridge of his nose?
Can he use a shingle when fixing the roof of his mouth,
And to nail them, use the nails of his toes?
Can the crook of his arm be sent to jail?
If so what did he do?
How does he sharpen his shoulder blades?
I am sure I don't know, do you?
Can he sit in the shade of the palm of his hand?
Can he beat the drum of his ear?
Can the calf of his leg eat the corn on his toes?
Then why not grow corn on the ear?

—*Whizz Bang.*

Would You?

My parents told me not to smoke,
I don't.
Or listen to a naughty joke,
I don't.
They make it clear I must not wink
At handsome girls, or even think
About intoxicating drink;
I don't!

To dance and flirt is very wront,
I don't.
Wild men chase girls and song,
I don't.
I kiss no girls—not even one,
I do not know how it is done,
You wouldn't think I had much fun,
I don't.

Porter: "What makes those red spots on either side of your nose?

Scott: "Oh, those? They come from glasses."

Porter: "Glasses of what?"

One day last December as near as I remember
I was strolling down the avenue,
My step was full of pride,
When my heart began to flutter,
So I lay down in the gutter
And a hog came up and lay down by my side.

As I lay there in the gutter
With my heart all in a flutter,
A lady passing by was heard to say:
"You can tell a man that boozes
By the company which he chooses,"
And the hog got up and slowly walked away.

Never Was.

"The Navy hain't wot she uster be!" whined the six-year man.

"No, and she never wuz!" declared the nineteen-year man.

1950

"And he promised to come straight home from the office"

AERIAL AGE WEEKLY

VOL. 13, No. 21 | AUGUST 1, 1921 | 10 CENTS A COPY

A Remarkable Airscape of Entire Manhattan Island. Photographed for the Fairchild Aerial Camera Corp. by W. L. Hamilton

The Navy's Urgent Need

PUBLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
Subscriptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

BUY IT FROM THE NAVY

STANDARD SCOUT AIRPLANES.

These planes are single seaters and have single control. All planes are equipped with the Le Rhone 80-horsepower rotary motors. The planes are new and unused.

Location.—Three planes, Navy Yard, Charleston, S. C.; three planes, Hampton Roads, Va.

These are land machines purchased from the Bureau of Aircraft Production. These planes are practically the same as when they left the factory and are in excellent condition, subject to deterioration due to storage only.

Cost, $7,867.73 . . . . **Sale price, $1,000**

Write today for the Catalog on Aeronautical Equipment, which contains data in regard to planes, motors, spare parts, radiators, tachometers, altimeters, aero watches, compasses, clocks, propellers, thermometers, barographs, cameras, and other aeronautical equipment.

The surplus materials that the NAVY has for sale have been grouped as shown below and catalogs describing these materials will be sent upon request.

Marine Supplies. Boats and Vessels.	Canvas and Tents. Clothing and Textiles	Machinery. Machine Tools.	Marine Hardware and Navigation Instruments.	Contractors' Equipment Rope and Twine.
Plumbing Supplies. Valves and Fittings. Bathroom Supplies.	Chemicals. Oils and Greases. Paint and Paint Materials.	Electrical Equipment. Radio Equipment. Wire and Cable.	Ferrous and Non-Ferrous Metals in Bars, Plates, Sheets and Tubes.	Hardware and Tools. Furniture. Office Equipment. Stationery and Books.

SALES OFFICES

BOARDS OF SURVEY, APPRAISAL, AND SALE

AT

NAVY SUPPLY DEPOT
BROOKLYN, N. Y.

NAVY YARD
PUGET SOUND, WASH.

AND THE

CENTRAL SALES OFFICE

NAVY DEPARTMENT - WASHINGTON, D. C.

SALES ROOMS BLDG. 176 *NAVY YARD*

WASHINGTON, D. C.

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, *at the Post Office at New York, N. Y., under the Act of March* 3, 1879.

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIII NEW YORK, AUGUST 1, 1921. NO. 20

A Consolidation

WITH this issue, FLYING, the monthly aeronautical journal which was established in 1912, is consolidated with AERIAL AGE WEEKLY. AERIAL AGE, from the standpoint of prestige and circulation, has been the leader in American aeronautic journalism, and by the accession of the large body of *Flying* readers throughout the entire world, it now assumes a unique role in relation to the world aeronautics. It now has by far the largest circulation of any aeronautic publication published in the English language, and it will wield now an even greater influence for the advancement of aerial transportation and for the broadening of the American aeronautic industry.

Through a number of causes, aeronautic development and application is moving all too slowly in America, but there are now clearly defined evidences of constructive progress. AERIAL AGE stands squarely behind all movements for the advancement of aeronautics, and offers every encouragement and cooperation to plans that will develop business for the American industry.

The Navy's Urgent Need

A NAVAL bill that provided $90,000,000 for new capital ships and nothing for fast aeroplane carriers was a blunder before army aviators sank the German dreadnought Ostfriesland with 2,000-pound bombs. Who will now defend the action of the House in striking from the Senate bill the appropriation for two carriers? At the present time the navy possesses but one carrier, the Langley, formerly the collier Jupiter; it is the joke of the service, because its maximum speed is only twelve knots. As Congress made an appropriation for this ark of an aviation ship that everybody knew would be obsolete as soon as she was fitted up to carry planes, ignorance of the sore need of the navy could not be pleaded when the Senate proposal was rejected.

Great Britain, whose fleet includes seven aeroplane carriers with a speed of from 25 to 31 knots, is, in good-will at least, as much our ally today as she was during the conflict with the Central Powers. War with Great Britain is inconceivable, say eminent publicists, and it is the general view. But if Great Britain were disposed for any reason to compete with the United States in naval armaments, she would be gratified to observe Congress neglecting aviation while continuing to build capital ships that could be sent to the bottom by bombs dropped from the air. If war with Great Britain is inconceivable, hostilities with Japan might be precipitated by the failure of diplomacy to settle questions in controversy relating to Yap, Shantung or land laws. Japan is now building a carrier of battle-cruiser speed that will accommodate thirty aeroplanes. It is to be the first of a squadron and will be completed next year. A ship of this kind takes almost as long to build as a battleship. Great Britain's swiftest carrier, the Furious, has a length of 735 feet and her displacement is 19,100 tons. She was laid down as a capital ship and converted. If Congress voted appropriations for two carriers tomorrow, they would not be completed before the end of 1922, or later.

Before it was known in Washington that the aviators could destroy a capital ship there were intelligent students of naval warfare who urged the addition to our fleet of aeroplane carriers. On May 5 Representative Britten of Illinois introduced a bill for the construction of two such ships. "The war," he said, "has taught us that without adequate aviation support at sea our navy would be helpless before an enemy controlling the air." Secretary Denby went before the House Naval Committee a week later and begged for one carrier. The committee gave its approval to a bill providing for such a vessel, but the short-sighted economists on the floor of the House were satisfied with the absurd Langley. At the same time they were ready to vote $90,000,000 for construction work upon the capital ship program of 1916. It should now be understood that the powerful Pennsylvania and the more formidable Maryland would be vulnerable to bombing attack, although a larger explosive than finished the Ostfriesland might be required to demolish them. If it is true, as General Williams said, that the bomb that sank the German dreadnought was heard round the world, may it not be hoped that ears in the House of Representatives were not impervious to the explosion?—*Editorial in New York Times.*

The News of the Week

Pulitzer Race Plans Cancelled

The Pulitzer Race, which was scheduled to be held in Detroit under the auspices of the Detroit Aviation Society, in September, has been cancelled. In a letter to the officers and directors of the Society, Colonel Sidney D. Waldon, gives the reasons for this action as follows:

In the firm belief that we had the full cooperation and support of the Army and Navy in the running of a big aerial race meet this Fall, the Detroit Aviation Society, Inc., was organized, and a great deal of good work done by its officers, directors, committee chairmen and members. There was never any question but that the races were desired by both Air Services as a very valuable means of stimulating engineering and making comparative tests under strenuous conditions of the best types of both Army and Navy equipment.

The first inkling of doubt about Government entries came about June 11th, in the form of a rumor that the Secretary of War had ordered the Army not to participate. It was not, however, until practically June 20th that we had definite advice from the Army Air Service that their participation had been denied by the Secretary of War, but stating that the same request for authority might be resubmitted July 1st, after the Army Appropriation bill had been passed.

A day or two later we received a very encouraging letter from the Navy Department, under date of June 25th, signed by Captain Moffett, indicating that the Navy was considering the entry of nine (9) machines.

On Friday, July 1st, Harold H. Emmons, counsel for the Detroit Aviation Society, Inc., called on representatives of the Army and Navy but could obtain no definite committal from either department. The impression he gained was that the matter would not be definitely decided for another ten days.

On July 14th, Harold H. Emmons and the writer had interviews with the Air Services of both Army and Navy, as well as interviews with the Secretaries of War and Navy. It was apparent on this date that while the Air Service officers themselves were keen for the holding of the air meet, that the Secretaries were inclined to deny the authority and funds.

At the close of our interview with Secretary Weeks late in the afternoon of July 14th, he agreed to call Major General Menoher into conference the first thing Friday morning; that he would also take up the matter with the Secretary of the Navy, before or after a Cabinet meeting at noon, and that he would give us the answer for both at 5:00 o'clock Friday afternoon.

The writer saw Secretary Weeks Friday evening, and received his decision that in view of the urgent necessity for economies in all branches of the Government—(and particularly in view of the shortage of certain appropriations affecting the Army Air Service)—that neither the Army nor the Navy would participate in these races this year. The Secretary of War agreed to write a confirming letter, which however has not as yet been received.

We endeavored to make clear to both Secretaries the obligation that we owed to every worker and contributor to this project—that we were undertaking it for the advancement of the science of aviation and in no wise for personal gain—and that both the Army and Navy and ourselves owed quite an obligation to these same workers and contributors to hold the event as early next year as would be most satisfactory to the Army and Navy.

It is with very deep regret that I am writing this letter to acquaint our whole organization that our air meet must be postponed to next summer.

Harding For Uniting All Aircraft Services

Washington—President Harding favors the proposal to place all the aircraft services of the Government, miltary and civil, under one central authority, according to a correspondent of the New York Times.

There has been an impression that the President was opposed to this plan, especially when Major Gen. Menoher, Chief of the Air Service of the army, asked the Secretary of War to remove the Assistant Chief, Brig. Gen. William Mitchell, who was a persistent advocate of amalgamation of the army and navy air services. It was learned, however, that the President is heartily in favor of the proposed amalgamation and that the Joint Reorganization Commission, which is engaged in preparing plans for a reorganization of the executive branch of the Government, is inclined to recommend the unification of all the Government's aircraft activities.

The position of President Harding is that amalgamation will work for efficiency and economy. One great difficulty of the present separate aircraft services that has impressed him is that there is no systematic method of awarding contracts for the construction of aircraft. One branch makes contracts without regard to any other Government aircraft organization, and the President believes that this is detrimental to the upbuilding of private aircraft manufacture in the United States.

The aircraft manufacturers are dependent almost entirely on Government patronage, as commercial demands are very small, and it is claimed that unless the Government so arranges its contracts as to distribute them among all those concerns which produce aircraft meeting Government standards some of them may be obliged to go out of business.

The inference is also drawn from what was learned of the President's position that he is in favor of the amalgamation of the War and Navy Departments into a Department of National Defense. The plan under consideration by the Reorganization Commission contemplates having a Cabinet officer at the head of this department with Assistant Secretaries under him, in charge of the army, the navy and the aircraft service.

James Wins London Derby

J. H. James won the aerial Derby of 200 miles July 17, consisting of two one-hundred-mile circuits around London. No Americans were among the twelve starters.

The race started at Hendon, with turning points at Brooklands, Epsom, West Thurrock, Epping and Hertford. James, who is considered the best flyer since the death of Harry Hawker, was the winner of two trophies, both for the fastest time and handicap with $3,000 in cash presented by the Royal Aero Club. James covered the 200-mile course in 1 hour and 14 minutes or at an average speed of 163.34 miles per hour.

As a prelimnary to the Derby an inter-university air race took place between teams representing Cambridge and Oxford. The course was three times around a forty-mile circuit touching Hendon, Epping and Hertford. The race was won by Cambridge on points.

National Airways Centre in New York

New York city and New York State, both for military preparedness and for commercial enterprise, are counted upon by the War Department to take a progressive, leading and important part in the development of great national airways. Mineola is decided upon by the War Department for one of the group aerodromes, with strategic locations along the Atlantic coast.

The War Department has drafted tentative plans for eight great airways, three of which are transcontinental, as part of the programme for developing the air service. These airways are to be developed through the National Guard, constituting one-third of the reorganized arms, and the organized reserve, constituting one-half of the reorganized army.

One of the transcontinental routes starts from New York, hitting the principal southern great lakes ports as it proceeds westward to Seattle, and connecting at Chicago with another transcontinental airline to San Francisco. By a short flight from New York to Washington connection is made with the Eastern terminus of the mid-continent route from Washington to San Francisco. New York also is on the Atlantic coast airway from Portland, Me., to Key West.

Many places in New York State have been selected by the officials of the Air Service as headquarters for units of the National Guard and organized reserve, these citizen soldiers to be in charge of the local aerodromes, municipal landing fields and radio signal stations. The proposed distribution of these air service units in the Second Corps Area, including New York, is as follows:

Albany—One division air service, one corps air service headquarters, one air park, one communication section, two aerodrome companies, one pursuit squadron—all of these units being of the organized reserve.

Atlantic City—One division air service (National Guard) and one balloon company (organized reserve).

Binghamton—Where a municipal aerodrome is already available, one observation squadron of the organized reserve.

Buffalo—One group headquarters, one balloon company, one balloon park, one communication section, two attack squadrons, one air park, one group headquarters and two observation squadrons—all of these units being in the organized reserve.

Ithaca—One observation squadron and one photo section, both of the organized reserve.

Mitchel Field—One observation squadron and one photo section, both of the regular army.

Newark—One balloon company and one communication section, both of the organized reserve.

New York City—One division air service (National Guard) and the following units, all of the organized reserve: One corps air service headquarters, two observation squadrons, one air park, one photo section, one communication section, one army air service headquarters, one headquarters squadron, one aerodrome

company, two group headquarters, two pursuit squadrons, two attack squadrons, one air park, one photo section, one general air service headquarters, one headquarters squadron, one airship company, one aerodrome company.

Plattsburg—One division air service and one balloon company, both of the organized reserve.

Poughkeepsie—One observation squadron of the organized reserve.

Rochester—One division air service, two photo sections, one group headquarters, one balloon park, one communication section, one pursuit squadron, two photo sections, one balloon company and one balloon park, all these units being of the organized reserve.

Schenectady—One pursuit squadron of the organized reserve.

Syracuse—Two pursuit squadrons and one air park, both units being of the organized reserve.

Trenton—One balloon company, one group headquarters and one photo section, all three being of the organized reserve.

Troy—One pursuit squadron, organized reserve.

Wilmington, Del.—One balloon company, organized reserve.

Big Reunion of Air Men

For the first time since the war, men who served in the air forces are to have a reunion, at the International Air Congress, in Omaha, Nebraska, November 3, 4 and 5, the three days immediately following the American Legion Convention at Kansas City, just a short distance from Omaha.

At the reunion to which every one interested in the promotion of aviation and the maintenance of America's supremacy is invited, a national air organization will be formed with those ideas in view. At the present time, state bodies are being organized in each state to send delegates to the national meeting.

All American Aces will be invited to come, as well as prominent men in the air game, and other notables, including President Harding, Marshal Foch, Sir Douglas Haig and others.

Governor S. R. McKelvie, Secretary of State Darius Amsberry, Mayor James S. Dahlman and Commissioner Dan Butler signed the invitations to President Harding, Marshal Foch and others.

The invitations were sent to the state capitol by aeroplane, the ship belonging to the Aero Club of Omaha, Inc., which is promoting the big congress. The invitations were signed by state officials and then rushed back to Omaha by air and sent to Washington by air mail within a few hours.

At the Congress a complete exhibit of all types of aircraft manufactured will be shown in three big circus tents near the flying fields. Air equipment, guns, bombs, airial cameras, parachutes, and everything pertaining to airial development will be on display. Manufacturers are already making reservations.

Over $10,000.00 in cash prizes are to be offered in the air meet, which will be held in connection with the exhibit and reunion. Events will consist of derbies, sprints, climbs, feature races and events for balloons and flying boats. A big prize will be offered for a record in the altitude contest.

Other features of the Congress will include an aerial pageant, depicting the bombing of a French Village and a battle in the clouds for which the assistance of the General Electric Company has been obtained.

Among the men who will come to Omaha for the Aero Congress will be hundreds of men who served in Europe. Group unions will be held for the men who served in the various squadrons, escadrilles and training schools.

The Aero Congress promises to be a great big event and every man interested in aviation is urged to attend.

N. E. A. by Aeroplane Aid Beat All Competitors

Jack Dempsey knocked out Georges Carpentier at 3:31 Saturday afternoon, July 2, in the great arena at Jersey City.

And at 12:16 Monday afternoon, about 48¾ hours later, the Newspaper Enterprise Association, by means of special airplanes, a special train and the United States airmail service, delivered pictures of the knockout in San Francisco.

Four N. E. A. camera men, under Bob Dorman, chief N. E. A. photgrapher, snapped shutters while the referee was counting the toll over the prostrate body of Carpentier. Four couriers carried the plate holders to four waiting motor cyclists outside the arena. These machines rushed the plates to the aeroplane landing field a mile away, where they were packed in wooden boxes and hurried aboard three Curtiss Oriole planes, one piloted by R. H. Depew, Jr., manager of the Curtiss Flying Field at Garden City, Long Island, another by John M. Miller and a third by Wesley L. Smith, a United States airmail pilot. Miller was to carry his plates to Bellefonte, Pa., where they were to be transferred to another Curtiss Oriole piloted by E. M. Ronne, manager of the Curtiss field at Buffalo.

The three machines took off with a rush at 3:50 p. m., bound for Cleveland. They stopped a few minutes to re-gas at Bellefonte, Pa., and then roared down the home stretch to Cleveland, where they arrived at 8:30. One hour later the Cleveland Press was on the street with a picture of the knockout in a special edition. It was the first paper in Ohio or the west to turn the trick.

Waiting automobiles sped like the wind to the main plant of the N. E. A. in Cleveland, where the plates were developed.

L. Van Oeyen, Clarence Stieglitz, N. E. A. photographer who flew in one of the planes from Jersey City to Cleveland, and several assistants hurried aboard a special train chartered by the N. E. A. To this train was attached a baggage car which had been transformed into a photographic studio complete in every detail. While the special was rushing from Cleveland to Chicago, always at a rate of more than 60 miles an hour, prints were made for the N. E. A. clients throughout the west.

The special train glided into the La Salle Street station at 4:50 Sunday morning, where R. J. Gibbons, Chicago representative of the Newspaper Enterprise Association, had in waiting taxicabs which carried prints to the United States airmail field to a special plane chartered by the Newspaper Enterprise Association and piloted by Ralph C. Diggins, and to the first trains leaving in all directions.

The United States mail plane hopped off at 8:30 a. m. After a rapid flight the plane transferred its packages of pictures to a mail train at North Platte, Neb., at 3 o'clock Sunday afternoon. Without a moment's delay the pictures were whirled onward to Rock Springs, Wyo., where a United States mail plane was in waiting to rush them to the Pacific coast. The transfer at Rock Springs was made in record time and the U. S. plane started its flight for San Francisco, more than 800 miles away. The necessary stops to replenish the gas and oil tanks were made, but aside from that the plane continued its steady distance-eating flight without incident.

At 12:16 Monday afternoon it landed at the United States airmail field in San Francisco where the prints were conveyed to the plant of the San Francisco *Daily News*.

The flights made by the United States airplane and the N. E. A. special plane piloted by Coffee from Laramie to San Francisco are regarded as two of the best air performances ever made in the west.

The latest type of Fokker Commercial Limousine, with A. A. G. Fokker, the designer, at the wheel

The AIRCRAFT TRADE REVIEW

Fokker to Build American Planes

Coincident with the arrival at Hazelhurst Field, L. I., July 21, of the Fokker limousine, five-passenger monoplane, comes the announcement that the Netherlands Aircraft Manufacturing Company of Amsterdam and New York will shortly commence the manufacturing of Fokker machines of all types in this country. The limousine, which is known as the Fokker F-III, will be thoroughly demonstrated this afternoon by Bert Acosta, probably the best known civilian pilot in this country, who has become test pilot for the Dutch company. Anthony H. G. Fokker, whose machines are now carrying passengers on every airway in Europe, said when he visited this country recently that he regarded the United States as the most fertile field for aircraft exploitation, and signified his intention of invading the American field as soon as his European contracts would allow. The limousine is the first of the ships he has sent here to make good his promise.

R. B. C. Noorduyn, who with F. Cremer is taking care of the Netherlands interests here, said yesterday that the limousine is the highest development of the passenger-carrying aeroplane now in use in Europe.

"Its design emphasizes the fact that war machines are not adaptable to commercial use," he said, "and Mr. Fokker was one of the first to understand this. The war machine, of which there are thousands in Europe, is too expensive and too dangerous to operate commercially. The war machines were about as useful for commercial air transportation as a battleship would be when converted into a trans-Atlantic liner.

"Realizing that the operating costs must be reduced to a minimum and the useful load increased as much as possible, Mr. Fokker as soon as the war ended set to work to design successful commercial aeroplanes. The limousine now at Hazelhurst Field is the last development in the way of a passenger-carrying ship. It will carry, in addition to the pilot and fuel sufficient for more than 500 miles' flight, five passengers and their luggage or, instead, more than 1,000 pounds of freight. With a motor of only 220-h.p. and a fuel consumption of about twelve gallons of gasoline an hour this machine will maintain an average speed of 105 miles per hour. The cabin is very roomy and contains seats for five passengers, two of which are easy chairs. It is beautifully upholstered on the sides and ceiling, and the floor is heavily carpeted. There are three windows on each side, two of which may be opened with ease, and the temperature of the cabin is regulated so as to be always comfortable, no matter how hot or cold it may be outside.

"The fact that the limousine is a monoplane, with the wing high above the carriage, allows the passengers an uninterrupted view when in flight. The wing, which is more than two feet thick, is built on the cantilever principle and needs no struts or guys to support the carriage. This limousine is the most advanced type of passenger carrying aeroplane, and its record performances are attested by the thousands of passengers who are being carried successfully each week abroad."

Arrangements have been made by the officials of the Netherlands Company for a series of flights out of New York. One of the first of these will be a non-stop trip to Washington, where the machine will be demonstrated for the benefit of Government officials. It is expected that the manufacture of Fokker machines by American mechanics from materials obtained in this country, will commence early this Fall.

Davis-Douglas Company Reorganized

The Davis-Douglas Company of Los Angeles, Cal., has been reorganized and is now engaged exclusively on government contract work.

The officers of the company are as follows: Donald W. Douglas, Pres.; Wm. M. Henry, Vice-Pres. and Sec.; H. C. Rich, Treas.

Tri-City Aerial Transportation Company

The R. H. Bloxham Aviation Company of Chicago has been consolidated with the Tri-City Aerial Transportation Company of Rock Island, Ill. In addition to exhibition work the company is conducting a school of instruction.

The officers of the company are H. L. Brandenburg, Pres.; J. J. Gruske, Secy.-Treas., and R. H. Bloxham, Gen. Mgr. and Chief Pilot.

Field at Cleveland, Tenn.

A landing field has been established at Cleveland, Tenn., and is named Emmett Flying Field. It is situated a half mile west from the center of the city. It has a standard marker and cross-country aviators are invited to use the field.

Aerial Newspaper Delivery

The Oregon, Washington & Idaho Airplane Company of Portland, Oregon, western distributors for the Curtiss Aeroplane & Motor Corporation, report an interesting commercial venture in the delivery of newspapers.

Last year from mid-June until September, on seventy-five consecutive week days, copies of the Oregon Journal were delivered to Seaside and Astoria from Portland by flying boat, a distance of 120 miles. By this method the Journal beat all other papers by hours and is consequently very popular with the large summer colony at these beaches.

Because of the success of this delivery during 1920, the service is being repeated this year, the first papers being carried on July 3rd with complete details of the Carpentier-Dempsey fight.

It is the boast of the company operating the line that the papers will be delivered in spite of weather and to date they have supported this boast by a 100% service.

New French Altitude Record

Paris.—Lieutenant Kirsch, the French aviator who was a contestant last year in the James Gordon Bennett Cup race at Etampes, is declared to have reached an altitude of 10,600 meters (about 34,768 feet) July 15 in an attempt to break the world's altitude record. Although the official world's altitude record made by Capt. R. W. Schroeder, of the United States Army, at Dayton, Ohio, on February 27, 1920, is only 33,000 feet, it is thought improbable that the Aero Club of France will certify Lieutenant Kirsch's record.

Lieutenant Kirsch started his flight at Le Bourget aviation field, near Paris, and landed at Champaubert, Department of the Marne, more than one hundred miles northeast of Paris, when engine trouble compelled him to descend.

During his flight the aviator noted a temperature of 69 degrees below zero, while thermometers in Paris registered 97 degrees above.

Seaplane Landing at Yorktown

Seaplanes landing at the flying field at Yorktown, Pa., are advised that shoal water extends 300 yards off the southern bank of the York River abreast the field. Landings should be made well offshore and planes taxied to the beach by way of the channel extending into the mouth of Felgates Creek. A line of stakes has been placed to mark the eastern edge of this channel. Planes should be beached as close as possible to the dock at the mouth of Felgates Creek, as the shoal referred to uncovers at low water.

Gasoline, oil, and facilities for minor repairs are available. Large planes anchoring off the beach can obtain a motor dory by signaling to the dock.

Personal Par

Frederick Trubee Davison, eldest son of Henry P. Davison of the firm of J. P. Morgan & Co., has been endorsed for the Republican nomination for Assemblyman from Nassau County by the Republican Town Committee of Oyster Bay.

D. J. Spence, Jr., was the first member of the Aero Club of Pennsylvania to win the club badge given for bringing in new members.

Hawker's Death Due to Paralytic Stroke

Harry Hawker lost control of his aeroplane owing to his physical disability. This was the verdict returned by the coroner's jury at an inquest on the famous airman.

Medical evidence was given that Hawker suffered from tuberculosis of the spine. A post-mortem examination showed that a hemorrhage had taken place, and the doctor came to the conclusion that as a result of the hemmorhage the airman became paralyzed and lost control of his machine.

A physician testified that Hawker had been advised not to fly for some time, that his physical condition was not strong enough for him to fly and take risks. Hawker did not realize, nor did his friends, how serious his condition was. His disease had advanced to such a point that the slightest movement or strain could have caused the final rupture which led to a hemorrhage. Hawker, as the physician expressed it, was absolutely on his last legs.

THE BRISTOL COMMERCIAL TEN-SEATER BIPLANE

A NEW commercial type aeroplane has recently been completed by the Bristol Aeroplane Co.

This new Bristol is a large ten-seater single-engined tractor biplane, having an enclosed cabin for eight passengers and an open cockpit for pilot and mechanic.

The 450-h.p. Napier "Lion" engine, with which this machine is fitted, is on a readily detachable mounting which also carries the nose radiator and oil tank. Complete access to the engine can be obtained by releasing six self-locking fasteners, no part of the cowl being removed from the machine. Electric starting is fitted, as well as hand turning gear operated from the ground.

The *fuselage* is of deep rectangular section, with curved top deck, tapering to a shallow vertical knife-edge at the rear; the *fuselage* completely fills the gap between the planes. The saloon, or passengers' cabin, extends from the region of the front main wing spars well aft of the planes. Access to the cabin is by way of a door at the rear of the former, on the port side. Six of the passengers are located in separate seats, three a side, facing forward, and the other two passengers sit at the front end of the cabin facing aft. The seats are collapsible, and when folded project only five inches from the cabin sides, leaving a maximum of floor space should it be desired to carry cargo in lieu of passengers.

Two views of the Bristol Commercial Ten-Seater

Windows, which can be opened, are fitted the full length of both sides of the cabin, and heating is provided by means of hot air muffs round the exhaust pipes. For the convenience of passengers liable to air-sickness a small concealed self-emptying basin has been provided in close proximity to each seat. These fold against the side of the saloon and are readily accessible, the waste pipe discharging through the floor.

In the roof of the machine a special emergency exit is provided, measuring 2 ft. 2½ ins. by 2 ft. 2 ins. This is operated by a quick release gear should occasion arise.

When it is desired to use the machine solely for the transport of cargo the space available is: length, 10 ft. 6 ins.; height at center, 5 ft. 9 ins.; width, 4 ft.

The pilot's and mechanic's cockpit is located high up in the *fuselage* at the leading edge of the top plane. An exceptionally fine range of vision is thus provided.

Below the pilot's cockpit is a compartment 4 ft. 6 ins. long by 4 ft. wide by 2 ft. 6 ins. high, accessible through a trap door in the underside of the *fuselage*. This is intended for the conveyance of passengers' luggage or for other suitable cargo.

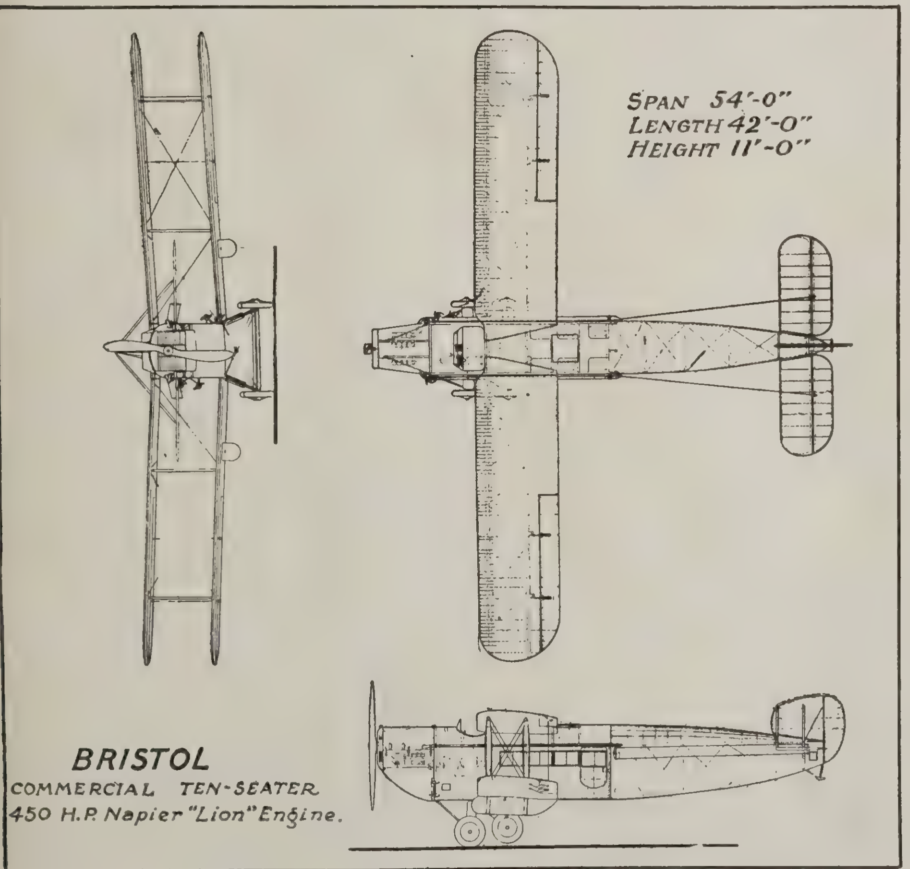
Between the engine compartment and the pilot's cockpit is a steel fireproof bulkhead, and all control connections pass through glands. No petrol is carried in the body of the machine aft of this bulkhead.

In the pilot's cockpit a complete wireless telephone and telegraph installation is installed, and has been fitted so as to be completely accessible to the mechanic. In order to allow of communication between the pilot and the passengers a small trap door has been provided to allow of messages being passed when required.

Single control of the wheel type is fitted, all cable pulleys being five inches in diameter. The tail incidence can be varied by a lever and quadrant adjacent to the pilot, to trim the machine under all conditions of speed and load distribution. All control surfaces are unbalanced.

The main planes are of equal span and chord, and are without stagger or sweepback, but are set at a pronounced dihedral angle. The lower planes are attached direct to the sides of the *fuselage*, and the top ones to small wingroots in the roof of the cabin. There are two pairs of interplane struts each side, and the landing and lift bracing is by streamline wire. *Ailerons* are fitted to all four wings.

The chassis is of the four-wheeled Oleo-elastic type, with wheels in tandem, brakes being fitted to the rear wheels and operated by a car type brake lever in the



pilot's cockpit. A gate is provided for the brake lever so that the brakes may be operated together or singly as required. Elastic rings are used for suspension and the elastic carriers have been designed for ready renewal of these rings. The Oleo plungers are fitted with a special type of tapered needle valve to control the passage of the oil through the plunger to give constant oil pressure throughout the stroke of eight inches.

The two main gasoline tanks, of 50 galls. capacity each, are slung under the bottom planes at the inner interplane struts. Gasoline is drawn from either of these tanks by two Vickers' centrifugal pumps coupled in series, and delivered through a Vickers' hand pump to the carburetors, any surplus passing to a 10-gall. gravity tank and overflowing back to the particular main tank in use. Smiths' capacity gauges for both main tanks are fitted on the instrument board.

The principal characteristics of this machine are as follows:—

Dimensions

Span	54 ft.
Length, overall	42 ft.
Height	11 ft.

Weights

As passenger machine—	
Machine empty with water	3,900 lbs.
Wireless installation	63 lbs.
Fuel and oil for 400 miles (100 galls. petrol, 6 galls. oil)	798 lbs.
Crew (two)	360 lbs.
Passengers (eight)	1,280 lbs.
Baggage (50 lbs. per passenger)	400 lbs.
	6,801 lbs.
As cargo machine—	
Machine empty, with water	3,800 lbs.
Wireless installation	63 lbs.
Fuel and oil as above	798 lbs.
Crew (two)	360 lbs.
Cargo	2,079 lbs.
	7,100 lbs.

Loading

As passenger machine—	
Weight/h.p. (Napier "Lion" at 450 h.p.)	15.1
Weight/sq. ft.	10.1
As cargo machine—	
Weight/h.p.	15.8
Weight/sq. ft.	10.6

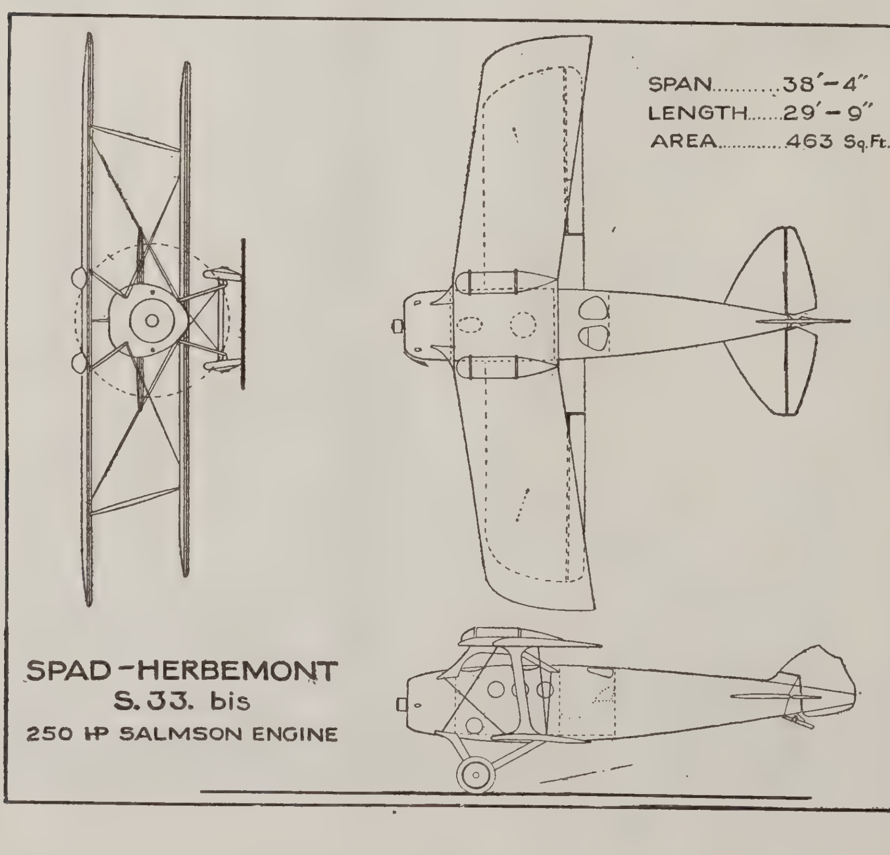
Performances

	Full load.	*Half load.*
Speed at ground level	122 m.p.h.	124 m.p.h.
Speed at 5,000 feet	118 m.p.h.	120.5 m.p.h.
Speed at 10,000 feet.	114 m.p.h.	117 m.p.h
Time to climb to 5,000 ft.	9 mins.	7 mins.
Time to climb to 10,000 ft.	22 mins.	17 mins.
Ceiling	13,500 ft.	15,500 ft.

THE SPAD "BERLINE" S.33

THE Spad "Berline," type S.33 six-seater, is of interest in showing M. André Herbemont's ideas of a commercial aeroplane.

In general lay-out, the Spad 33 follows previous machines of Herbemont's design. That is to say, the *fuselage* is of the *monocoque* streamline type, the wings are characterized by a backswept top plane, and a single interplane strut on each side. The rudder is of that curious fin shape (piscatorial not aerodynamic) which has for several years been typical of the Spads. The *fuselage* is of fairly ample proportions, much more so than in the earlier types, where the passengers were very much cramped. Seating accommodation is provided for five passengers in addition to the pilot. The arrangement of the seats is reminiscent in a general way of that of the Westlands. That is to say, the pilot sits well aft, on the port side. Next to him, and on a slightly lower level, is a seat for a passenger, who, however, sits with his head projecting through the roof, instead of being inside, as in the Westland. In front of the pilot's cockpit, which is partly partitioned off, are two wickerwork seats, one behind the other, along the port wall of the cabin. On the starboard side are two more seats, placed back to back. On the whole the cabin is fairly comfortable, although of somewhat Spartan appearance. There is no upholstery and no padding, but the cabin, with its white walls and numerous windows and port-holes, is light and well ventilated. The door is near the front of the cabin, on the starboard side, and it must be admitted that it is in an uncomfortably close proximity to the propeller. In fact it would appear that, as there are no external fastenings for keeping the door open against the slip-stream from the propeller, it has been the object of the designer to prevent the engine being run until all the passengers are on board.



SPAD-HERBEMONT S.33. bis
250 HP SALMSON ENGINE

In the roof of the cabin, and just clear of the leading edge of the top plane, is a hatchway covered with transparent material. This hatchway is evidently intended as an emergency exit in case, for some reason, the door is jammed; also the cockpit next to the pilot affords a means of getting out of the machine, so that, even in case of alighting on the sea, there should be a good chance for the passengers of getting out safely. The *monocoque fuselage* would probably keep the machine afloat for a considerable time.

The engine, a Salmson A-Z9 nine-cylindered radial water-cooled, is known as one of the most reliable of French engines. It is variously known as a 250 and 275 h.p., but in reality it develops, we believe, about 300 h.p. at 1,500 r.p.m. The bore and stroke are 140 mm. and 170 mm. respectively, and the fuel and oil consumption amounts to approximately 0.56 lb./h.p./hour at full power. The weight of the engine, including magnetos and carburetors, but without water, is 660 lbs. As will be seen from the accompanying illustrations, the engine is neatly covered in, with a circular radiator in front of it. A small door in the front wall of the cabin gives access to the carburetors and magnetos from inside the cabin, thus doing away with the necessity of removing the cowling for the purpose of inspecting these two accessories. Furthermore, there is a circular opening in the lower part of the cowl itself.

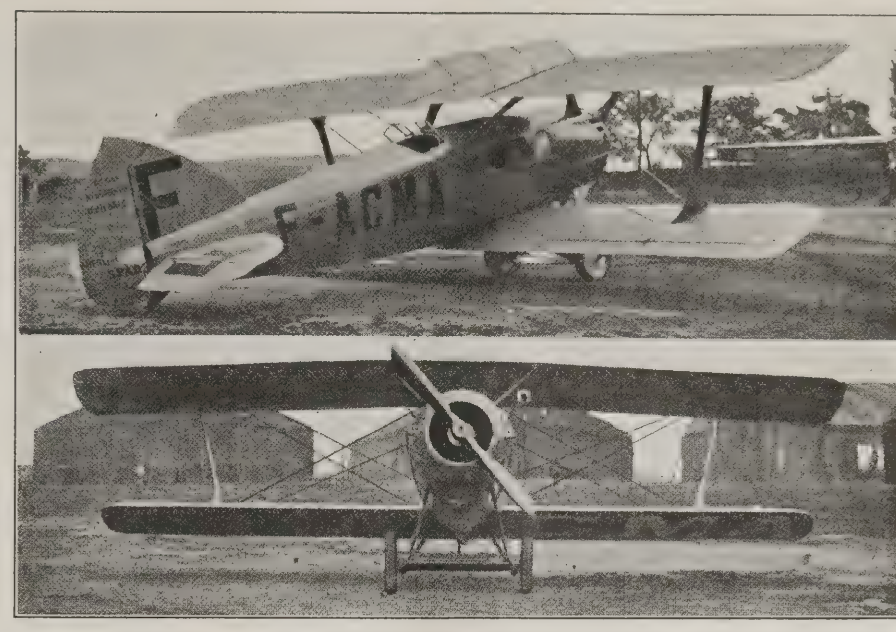
The gasoline system is of the simplest possible. Two large gasoline tanks are placed on top of the upper plane, and the supply to the engine is by gravity from these main tanks, thus doing away with petrol pumps, and at the same time getting all the petrol away from the cabin.

As regards the performance of the Spad "Berline," the machine should be fairly economical to run, as the load carried per horse-power is fairly high. At the same time, the speed is not by any means bad,

the top speed being in the neighborhood of 110 m.p.h., with a cruising speed of about 97 m.p.h. We have no information relating to the landing speed, but in view of the fact that the wing loading is approximately 9.5 lbs./sq. ft., the landing speed must be somewhat high. The machine is now in use by the *Messageries Aériennes,* alternating with the older types, and probably it is the intention of the management to substitute it, as requirements demand, for these.

Following are the main characteristics and performance data for the Spad 33:

Span, 38 ft. 4 ins.
Length overall, 29 ft. 9 ins.
Height, 10 ft. 6 ins.
Area, 463 sq. ft.
Weight empty, 2,200 lbs.
Useful load, 2,200 lbs.
Weight loaded, 4,400 lbs.
Load per sq. ft., 9.5 lbs.
Load per h.p. (300), 14.66 lbs.
Speed near ground, 110 m.p.h.
Speed at 3,300 ft., 110 m.p.h.
Speed at 6,600 ft., 109 m.p.h.
Speed at 10,000 ft., 105 m.p.h.
Climb: 3,300 ft. in 10 mins. 5 secs.; 6,600 ft. in 22 mins. 54 secs.; 10,000 ft. in 45 mins. 32 secs.



Two views of the Spad-Herbemont Commercial Biplane

THE PUEBLO FLOOD RELIEF EXPEDITION

THE expedition of three aeroplanes sent out from Post Field, Fort Sill, Okla., to render any assistance possible in connection with the flood at Pueblo, Colorado, serves to add to the already large field of usefulness in which the aeroplane can be utilized. The work expected of the planes sent to Pueblo was to patrol the Arkansas River, Fountain Creek and their tributaries and dams and keep the city informed in case a second flood or any dams or rivers gave way. The flight left for Pueblo on Sunday afternoon, June 5th, by way of Dodge City. The planes were equipped with machine guns, radio and photographic equipment, and piloted by Major Follett Bradley, A.S., First Lieutenant Fred C. Nelson, A.S., and First Lieutenant K. N. Walker, A.S., with First Lieut. Joseph T. Morris, A.S., and Sergeants Gall, Shepard and Corporal Brugh as passengers.

Skirting a number of heavy storms, the flight landed at Dodge City, Kansas, at 6:45 p. m., and found that city in a small state of excitement anticipating the flood which, it was contemplated, would reach there about noon the following day. Shortly after landing at Dodge City, a heavy rain began, which continued until 11:00 o'clock Monday morning, at which time the flight took off for Pueblo. Conflicting telegrams from officials of the State of Colorado as to servicing facilities were received by Major Bradley, who decided that it was advisable to land at Lamar, Colorado, approximately 90 miles from Pueblo, and take on additional gas in order that the planes would in no way be stranded when arriving at destination in case gas and oil could not be secured. Shortly after landing at Lamar, another heavy rain fell. During slight "let-ups" of the storm the planes were gassed, and at 4:00 o'clock the rain had subsided to such an extent that the flight again took off for Pueblo, following the river up to that city. No telegraphic communications could be received from Pueblo, but the Mayor of Lamar had been informed, in an unofficial way, that a second flood had struck Pueblo, worse than the first one, and that a five to ten-foot rise was on its way and requested that the radio operators be prepared to receive radio messages from the flight as to river conditions from Lamar to Pueblo. Radio communication was held with Ft. Lyons by Lieut. Morris. The rumor of the second flood proved to be unfounded, and Fort Lyons was requested to inform the towns east of the Fort that no further danger need be anticipated in connection with this second flood.

The flight arrived at ten minutes past five at Pueblo and flew over the city. The first impression of the city that one had from the air was that of a child's toy village which had been inadvertently kicked over by some careless foot. The business section of the town was the portion which had received all the damage. Box cars were strewn in all conceivable and inconceivable positions; in back yards of stores, upside down and crosswise of the tracks. Buildings seemed to be swinging at all positions from their original foundations. One lumber yard, which formerly occupied half a block, was strung over all of the lower part of the city. One steel bridge spanning the Arkansas River was broken in two and the sections lay alongside of each other. After circling the city, a landing field was selected four miles south of Pueblo's business district on the edge of the town and west of slag dumps of the Colorado Fuel and Iron Company. The field was an excellent one, nearly a mile long and half a mile wide, level as a floor, with hardly any disadvantages.

Colonel Hamrock, Adjutant General of the State of Colorado, arrived at the field shortly after the planes had landed, and the officers were taken to the Congress Hotel, at that time the headquarters of the Colorado National Guard and Colorado Rangers, who were in charge of the flood situation. Being located on high ground, this hotel fortunately escaped the flood. It was very crowded and very cosmopolitan in appearance. It seemed that everyone who had had any service whatever was wearing a uniform. Ex-emergency officers, National Guardsmen, Colorado Rangers, ex-Royal Air Force officers, Marines and Sailors thronged the place and, together with civilians carrying guns and wearing various kinds of badges, made quite an interesting spectacle. A dynamo of the flooded electric plant was put in operation, which furnished the hotel with light, the only building in town so furnished.

No flying being required the next morning, an inspection of the devastated district was made on foot. Dead animals and overturned automobiles were strewn about the city. The mud in some places was four and five feet deep. One Italian settlement was completely washed out; nothing but faint signs of former foundations being in evidence, and all buildings in direct line of the flood were either washed away or their foundations so shaken that they were unsafe to enter. Crews of men in rubber boots and armed with shovels were hard at work endeavoring to clean up the horrible mess. It is nearly impossible to visualize the destruction caused by the high water unless one were actually on the ground and witnessed it. The excellent spirit of the citizens, many of whom had lost everything, was remarkable.

In the afternoon patrols were made of the rivers for 50 miles, and favorable reports were returned to Military Headquarters. There were no further cloud bursts in the mountains, and no further danger from the river was imminent. Daily patrols were made until Saturday morning, at which time the Adjutant General released the flight so that it could return to Fort Sill.

Lieutenant-Colonel Cables, Engineers, requested that a mosaic map be made of Pueblo and a number of devastated mountain towns. An additional plane, more completely equipped for making mosaic maps, was requested from Post Field in order to effectively accomplish this mission.

The flight left Pueblo at 1:30, returning by way of Dodge City, arriving at Post Field at 8:45 p. m., making the return trip in six hours and fifteen minutes and bucking a strong wind all the way.

AEROPLANE FLIGHT ENDURANCE (1)

Aeroplane Flight Endurance (I)

Purpose

It is the purpose of this report to describe a chart which will serve as a ready means of determining for any aeroplane the minimum horsepower required or the maximum horsepower available at any altitude which it is possible for the aeroplane to reach. The construction of the present chart is based on the method of McCook Field Serial No. 1380 (Air Service Information Circular, Vol. II, No. 183), "Aeroplane Performance and Design Charts," and consists in combining several of the fundamental relations which are plotted in figures 2 and 5 of that report, to which reference should be made.

The chart should be useful in calculations of aeroplane-flight endurance for determining (*a*) the maximum time in the air with a given fuel supply at the altitude of minimum horsepower required; (*b*) the corresponding speed; (*c*) the fuel supply necessary for a given duration at any altitude, either at full power or with unthrottled engines. In addition the curves of horsepower at altitude as presented may be used to indicate absolute ceiling, and in the case of supercharged engines will provide a means for determining rate and time of climb in function of altitude, as well as service and absolute ceilings.

In duration flight problems it is necessary to know the unit fuel consumption as well as the horsepower. This report deals only with the latter and lays a foundation for flight tests conducted with the object in view of determining the variation of unit fuel consumption with throttle opening and altitude.

I. Minimum Horsepower Required

If the horsepower available from an aeroplane's engine were reduced until a condition was reached, such that the aeroplane could no longer climb from the ground, i. e., so that its absolute ceiling was at the ground, then that horsepower would be equal to the minimum horsepower required to sustain the aeroplane. The corresponding value of #/H. P. would be at its maximum within the range of flying ability. We can easily determine for any aeroplane this value of #/H. P.$_m$ (minimum required), study its variation with altitude and then convert it into the corresponding actual horsepower. The solution is entirely graphical.

In fig. 5, Air Service Information Circular, Vol. II, No. 183, is plotted absolute ceiling and corresponding speed in function of lbs./sq. ft. and #/H. P. corrected for "fineness." To find #/H. P.$_m$, it is only necessary to find on the absolute ceiling chart the intersection of the particular #/sq. ft. line with the zero absolute ceiling line, draw a horizontal to the particular "fineness," and drop a vertical to the #/H. P. at the ground scale. In Chart I of figure 1 this report is plotted the variation of #/H. P.$_m$ with #/sq. ft. for "fineness" 100, taken from the "Aeroplane Performance and Design Chart" as indicated above. Superposed on Chart I are various lines of "fineness," so that if we start with #/sq. ft., go horizontally to the #/sq. ft.—#/H. P.$_m$ curve, and if instead of reading

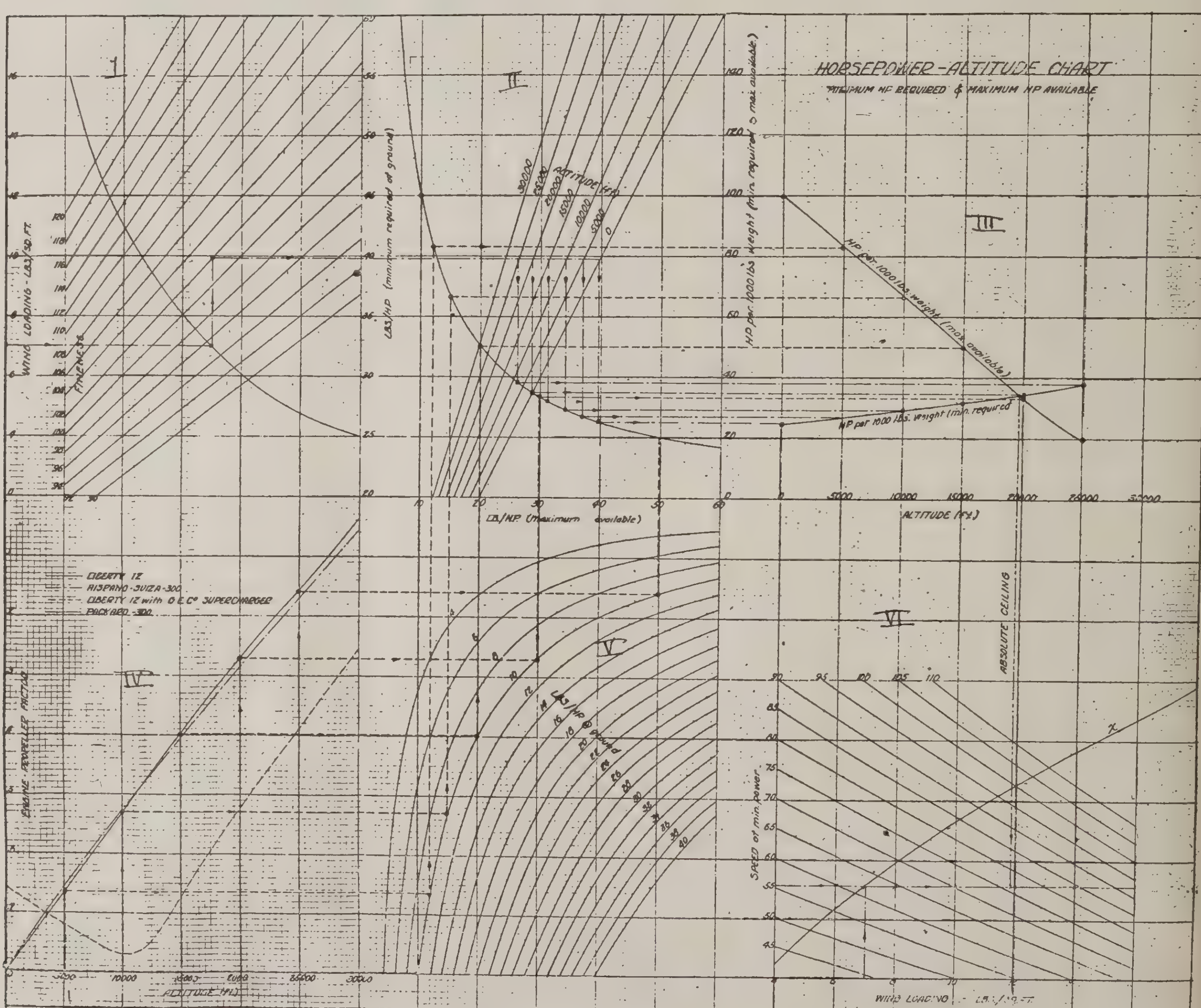


Fig 1—Horsepower Altitude Chart

#/H.P.$_m$ for "fineness" 100 as abscissae, we go next vertically to the "fineness" marked on the straight lines, thence horizontally to the right, we will find there the #/H. P.$_m$ corrected due to the particular "fineness." Since H. P. required varies inversely with (fineness)[3] (by definition), #/H. P.$_m$ varies directly with this factor and the straight lines of Chart I effect this multiplication.

At altitude, horsepower required, and hence its minimum value increases as the square root of the reciprocal of the relative density. Expressed in terms of loading per horsepower we have

$$\#/\text{H. P.}_m \text{ at altitude} = (\sigma)^{1/2}\ \#/\text{H. P.}_m \text{ at ground,}$$

where σ is the density at altitude relative to the density at the ground. Values are taken from Table I, which defines the standard atmosphere adopted by the engineering division. The altitude curves of Chart II, figure 1, effect this multiplication, so that if a horizontal from the #/H. P.$_m$ scale of Chart I were drawn to a particular altitude line, a vertical dropped from the intersection would indicate the #/H. P.$_m$ at that altitude. However, an additional curve has been introduced in Chart II, which performs a transformation from #/H. P.$_m$ to H. P.$_m$ per 1,000 pounds weight of the aeroplane, so that if from the point on the altitude line a vertical line is drawn to the new curve, a horizontal drawn from this intersection will indicate on the right-hand scale H. P.$_m$ per 1,000 pounds weight at the particular altitude.

Now in Chart III, figure 1, altitude is marked off as abscissae, so that we can plot the variation of H. P.$_m$ per 1,000 pounds weight in function of altitude, as we come from Chart II, having used various altitudes. Suppose that it is proposed to set up a record of endurance, considering maximum time in the air without landing. The weight empty of the aeroplane to be used is known, as well as the area and horsepower of the engine at the ground. "Fineness," if not known, is selected by comparison with the aeroplanes listed in Table II. Several weights fully loaded may be assumed and performances determined in each case by the method of Serial No. 1380, Air Service Information Circular, Vol. II, No. 183. In general the total weight will be limited by considerations of getting off; that is to say, rate of climb at ground, or by a minimum service or absolute ceiling defined by the topographical conditions of the vicinity in which the flight is to be made. The maximum total weight having thus been decided on, the weight of fuel it is possible to carry is known, due allowance having been made for possible additional tanks. Now to fly for the maximum time necessitates flying at minimum horsepower required at the particular minimum altitude, and the present chart, figure 1, will indicate this horsepower quantitatively. Now, if at that altitude and power the unit fuel consumption were known it would be possible to make an estimate of the possible endurance. Furthermore, reductions in total weight due to consumption of fuel can be taken into account, new H. P.$_m$ may be found as time in the air elapses, and by summation very close results may be obtained.

It might be an aid to the pilot to know at what speed to fly throughout the flight, in which case it can be found from Chart VI. the development of which is described in the following. Referring again to the absolute ceiling chart of figure 1, Air Service Information Circular, Vol. II, No. 183, we have in the zero ceiling line a surve of speed at zero absolute ceiling, hence speed at ground level at the altitude of minimum power required, with values of #/sq. ft. marked on the curve. This can be replotted with #/sq. ft. as ordinate and speed as abscissae with altitude as parameter according to the fundamental relation:

$$\text{V at altitude} = (1/\sigma)^{1/2}\ \text{V at ground (constant incidence)}$$

In Chart VI, figure 1, the relation has been expressed in such a manner that if a vertical is drawn from the #/sq. ft. scale to the conversion curve χ, and a horizontal constructed through the intersection, than a vertical dropped from the altitude scale of Chart III, will intersect the horizontal, and indicate the speed at minimum power at the particular altitude. It is pointed out that although the above relations between speed and lbs./sq. ft., as well as between lbs./sq. ft. and #/H. P. in the foregoing, are taken from the Liberty engine chart, the same relations obtain for any engine, since at zero altitude no consideration of power drop-off with altitude, peculiar to any engine, enters into the discussion.

II. Maximum Horsepower Available

A variation of the method for determining engine horsepower with altitude has been given in Air Service Information Circular Vol II, No. 183, with results plotted as shown in Curves VI, figure 2, of that circular. The characteristic dropofts found by the empirical-theoretical method, have been replotted in Chart IV of figure 1; with a curve of the Liberty "12" engine with G. E. Co. supercharger added. Charts IV and V are so arranged that if we start at any altitude as abscissae on Chart IV, draw a vertical to the particular engine curve, then a horizontal to the lbs./H. P. at the ground, a vertical from there would cut the top scale of Chart V, giving #/H. P. maximum available at the particular altitude. The lbs./H. P. curves, Chart V, simply multiply the lbs./H. P. at the ground by the reciprocal of the ratio of the engine propeller factor at altitude to the one at the ground, since, if H. P. decreases, then #/H. P. increases with altitude.

Now if we proceed from the first points on the lbs./H. P. lines of Chart V, vertically up to the conversion curve of Chart II, thence horizontally, we will find on the right-hand scale, H. P.$_m$ per 1,000 pounds weight, which can in turn be plotted against altitude in Chart III. Here is a means, then, of determining the actual horsepower of the engine for flight at full throttle at any altitude, and if the unit fuel consumption were known in function of altitude and horsepower or r. p. m., it would be possible to determine just how much fuel had to be carried for a certain flight endurance at high speed at any altitude. Such an endurance figure is generally specified for Army aeroplanes, and one of the purposes of this report is to provide a basis for a series of flight tests with the object in view of determining unit consumptions.

III. Cruising Flight

Instead of flying at high speed or full throttle and corresponding high unit consumption, it may be desired to fly with reduced throttle and at lower speed, but with a unit consumption so much lower that less fuel would be consumed in flying a certain distance. The latter condition of flight is more economical, though slower, and is called flight at crusing speed. Suppose we have set up the fundamental curves of Chart III for an aeroplane which is our example. At 10,000 feet, the maximum horsepower available is 66.5 per 1,000 pounds weight. Now suppose the engine is throttled to 50 H. P./1,000 lbs., what will be the speed in horizontal flight? Draw a horizontal from 50 on the right-hand scale of Chart II, from intersection with conversion scale drop a vertical through Chart V. Now draw a vertical from 10,000 feet, Chart IV, to the engine curve, thence a horizontal through Chart V, and the intersection with the previous vertical will indicate the corresponding #/H. P. at the ground. Using this value on the Performance Chart of Air Service Information Circular Vol. II, No. 183, figure 5, we can find the horizontal speed at 10,000 feet. Repeating this procedure for various throttle openings and altitudes, it will be possible to determine the best altitude and speed at which to fly most economically for a given distance.

IV. Supercharging[1]

In Air Service Information Circular Vol. II, No. 195 is described a method for finding the rate and time of climb, service ceiling and absolute ceiling of an aeroplane equipped with a supercharger. Rate of climb was first expressed in function of the ratio #/H.P.$_m$ /#/H.P.$_a$ for the aeroplane without supercharger, and then determined from this law for the aeroplane with supercharger and new values of the ratio. The solution was wholly analytical, whereas it can be made mostly graphical. In figure I we have set up the curves o fH.P.$_a$ an H.P.$_m$ with altitude. The ratio H.P.$_a$/H.P.$_m$ can be used for expressing rate of climb, since it is equal to the ratio #/H.P.$_m$/#/H.P.$_a$. Rate of climb depends on excess horsepower, so that the greater the horsepower available and the smaller the horsepower required, the greater the excess, the ratio, and the rate.

The intersection of the curves in Chart III, in any case, indicates absolute ceiling, since horsepower available just equals minimum horsepower required. When the rate of climb curve has been established for a supercharged job as outlined above, and in Air Service Information Circular Vol. II, No. 195, then service ceiling can be found when rate of climb equals 100 ft./min. Time of climb is obtained by integrating the rate curve.

V. Conclusion

The present chart provides a method upon which may be based a flight test program for definitely determining the unit fuel consumptions of engines in function of altitude and throttle opening or r. p. m. The importance of such data can not be disregarded, and once it is obtained by the method herein outlined, it can be used in conjunction with figure 1 to solve practically any problem of flight endurance. In the case of supercharged engines, figure 1 provides a basis for determining rate of climb, service, and absolute ceilings. Some

[1] An analysis of the Effect of Supercharging.

interesting results may be found with regard to endurance at altitude of aeroplanes equipped with superchargers.

TABLE I.—*Standard atmosphere.*[1]

Standard altitude	Temperature °centigrade	Percentage pressure	Percentage density	$\sqrt{\delta}$	$\sqrt{\frac{1}{\delta}}$
0	15.00	1.000	1.000	1.000	1.000
1,000	12.84	.965	.972	.986	1.015
2,000	10.75	.930	.944	.972	1.030
3,000	8.71	.897	.917	.958	1.043
4,000	6.73	.864	.890	.943	1.060
5,000	4.81	.832	.863	.930	1.075
6,000	2.95	.802	.837	.915	1.093
7,000	1.14	.772	.811	.901	1.110
8,000	— .61	.744	.786	.887	1.128
9,000	— 2.30	.715	.761	.873	1.145
10,000	— 3.94	.689	.737	.859	1.164
11,000	— 5.52	.662	.713	.845	1.184
12,000	— 7.05	.637	.690	.831	1.205
13,000	— 8.53	.613	.667	.817	1.226
14,000	— 9.97	.589	.645	.804	1.244
15,000	—11.35	.567	.624	.790	1.267
16,000	—12.68	.545	.603	.776	1.289
17,000	—13.97	.524	.582	.763	1.310
18,000	—15.21	.503	.562	.749	1.335
19,000	—16.40	.483	.543	.736	1.360
20,000	—17.56	.465	.524	.723	1.383
21,000	—18.67	.446	.505	.711	1.408
22,000	—19.74	.429	.487	.698	1.433
23,000	—20.77	.412	.470	.686	1.458
24,000	—21.76	.395	.453	.675	1.482
25,000	—22.72	.380	.437	.660	1.516
26,000	—23.64	.365	.421	.649	1.541
27,000	—24.52	.350	.406	.637	1.572
28,000	—25.37	.336	.391	.625	1.600
29,000	—26.19	.323	.376	.613	1.632
30,000	—26.97	.310	.362	.602	1.663

[1]Engineering Division.

Ground: 15° centigrade.
29.92 in. Hg.
0.07608# per ft.[3]

TABLE II.

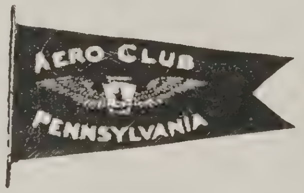
Aeroplane	Wgt.	Area	r.p.m. at ground	h.p. at ground	#/h.p.	#/ sq. ft.	High speed at ground	"Fineness"
Caproni Triplane	12,900	1,420	1,450	[1]1,050	12.3	9.1	100	90
G. A. X.	9,748	1,004	1,788	866	11.25	9.7	105	90
LePere Triplane	8,577	872	1,700	834	10.3	9.8	112	92.5
Martin Bomber	10,225	1,070	1,665	832	12.3	9.6	105	93
Martin Bomber[2]	9,185	1,070	1,700	834	11.0	8.6	106	93.5
Martin Transport	10,225	1,070	1,665	832	12.3	9.6	106	94
Martin Torpedo	12,098	1,080	1,675	833	14.6	11.3	105	94.5
JN-4-D-2	2,016	353	1,450	90	22.6	5.7	73	96.5
Loening	2,639	214	1,900	343	7.7	12.3	143.5	99
DH-9	4,065	490	1,580	388	10.5	8.3	113.5	99
DH-4	3,920	440	1,630	400	9.8	8.9	120	100
Fokker D-VII	2,100	236	1,560	184	11.4	8.5	117	104
Spad 16-A	2,844	328	1,670	240	12.1	8.8	116.5	104
LePere Biplane	3,774	391	1,725	420	9.0	9.6	136.5	107
VE-7	2,095	285	1,730	183	11.6	7.4	116.5	108
SE-5	2,090	245	1,725	180	11.4	8.4	121.6	108
Ordnance "D"	2,432	261	1,885	341	7.1	9.3	147	108
Junker L-6	3,605	417	1,445	243	14.8	8.6	111.2	108
U. S. XB-1A	2,994	406	1,730	316	9.5	7.4	124	109
Thomas-Morse MB-3	2,094	252	1,835	338	6.2	8.3	152	113
VCP-1	2,669	269	1,925	347	7.7	10.0	154	114
Thomas-Morse S-6	1,477	206	1,260	85	17.4	5.0	97	117

[1]Low compression Liberty "12's."
[2]Without bombs.

Air Service Information Circular.

OFFICERS

JOSEPH A. STEINMETZ, *President*
1421 Chestnut Street
WILLIAM H. SHEAHAN, *1st Vice-Pres.*
J. SIDNEY OWENS, *2d Vice-Pres.*
GEORGE S. GASSNER, *Sec. and Treas.*
1421 Chestnut Street



DIRECTORS

H. F. BAMBERGER
CHARLES L. HOWER
GEORGE S. IRELAND
FRANK A. L. LEAHY
JOHN W. PRATT

The stated monthly meeting of the Club was held in the Club Room, 1026 Walnut St., evening of July 15th. Lieutenant John Sydney Owens, chairman of the committee which was appointed to organize the local reserve flyers into an active unit, gave a most interesting report of the progress which had been made. Realizing the importance of the plane in modern warfare and the urgent need of an aviators' training field in this section for reserve flyers to continue their training and in some cases complete their instruction, the club fully discussed plans whereby it is hoped they can lease the large aviation field at Bustleton.

The Bustleton field has been abandoned by the air mail service and the local reserve aviators which are now being organized into an active unit desire to secure the field for instruction purposes. The field is ideal for the purpose, being well located, readily accessible and with large hangars already on the ground no preparation would be necessary for the housing of the two or three training planes which the Government would undoubtedly furnish.

Many of the reserve flyers in this section who won distinction in the late war have not figured in a flight since the armistice and an opportunity should be given these men to continue their training in preparation for another emergency.

Should the Club lease the Bustleton field as a training field it will be released to the Government at the rental of one dollar a year.

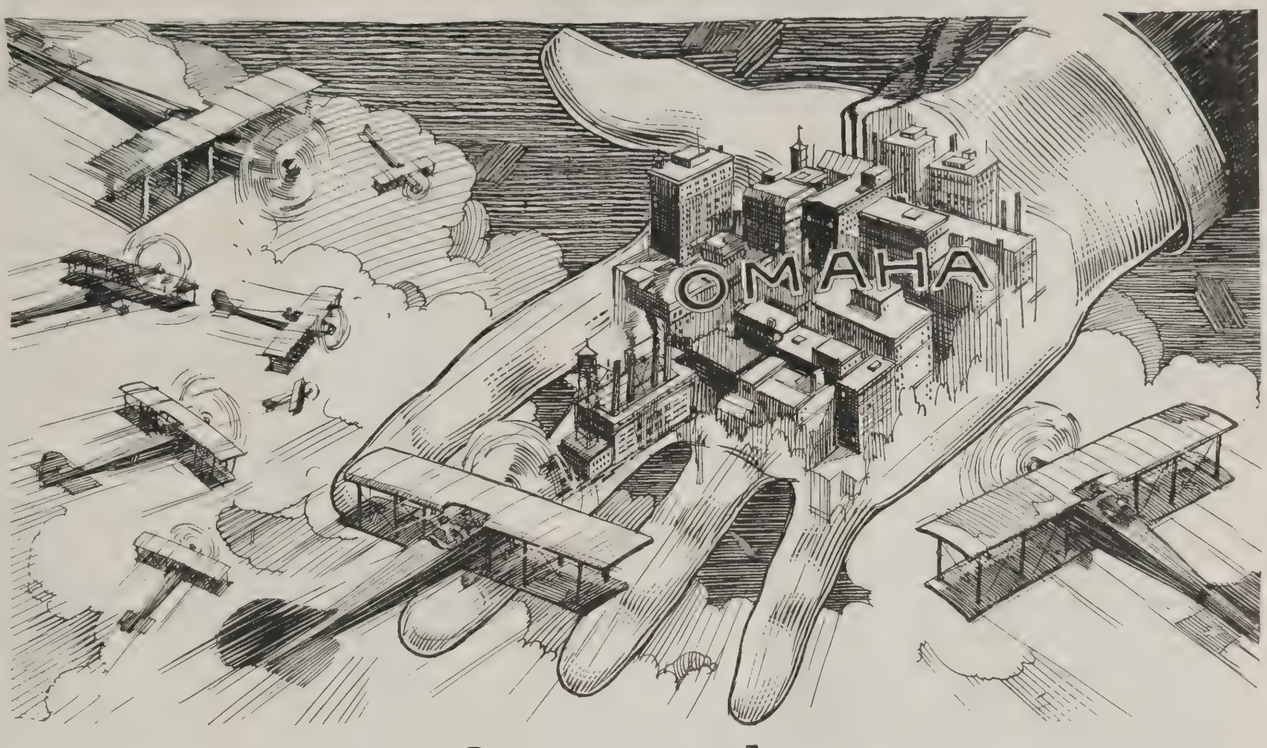
Mr. Frank Leahy, chairman of the Committee on Emblems, reported that the bronze emblem, in design similar to the Club badge, was nearly completed. It is planned to place same on the entrance to the club house where it will no doubt attract considerable attention. The design is of the badge, in abount a ten by twelve inch size, border, lettering and figure in relief bronze with background of blue enamel. The central figure will be a flying witch on a broomstick. This has been the insignia of the Club from the time it was organized in 1909.

Mr. Hower, chairman of the Entertainment Committee, reported that he is making an effort to hold the August meeting of the Club at Kennett Square, Pa., the latter part of the month. The plans have not been fully made but every effort is being put forth to have the Club hold a Field Day meeting. Mr. Hower, who is managing director of the Philadelphia Aero-Service Corporation, will have one of his planes fly over from the Warminster field, and The Curtiss Eastern Airplane Co., controlled by Mr. Geo. S. Ireland, a director of the Club, will no doubt fly one of their ships over to Kennett Square from their field at Pine Valley, N. J. To further add interest to the event, J. Sydney Owens will take to the meeting two or three of his most expert model flyers in the Boy Scouts of Philadelphia.

The body of Captain Hobart Baker, former Princeton football star, was among the war dead brought from France on the transports Somme and Wheaton. "Hobey" Baker, as he was lovingly called by all his friends, was killed in December, 1918, near Toul, the day before he was to leave for home. His plane developed engine trouble at a low altitude and crashed before he could regain control.

He brought down three German planes during the last ten days of the war. The French Government awarded him the Croix de Guerre.

W. H. SHEAHAN,
First Vice-President.


OMAHA

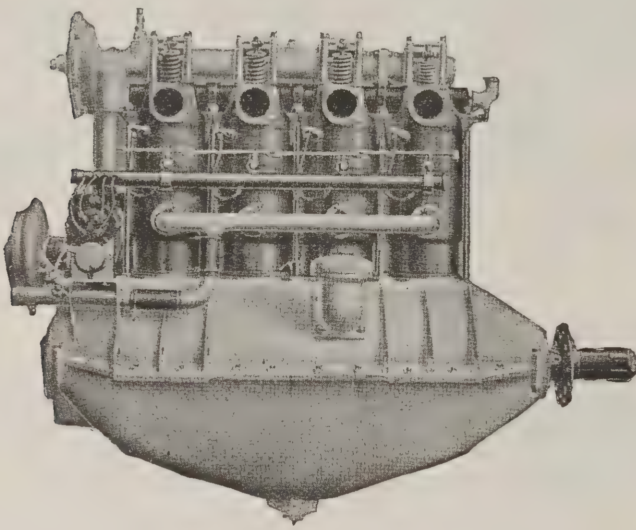
5742 Aeronautic

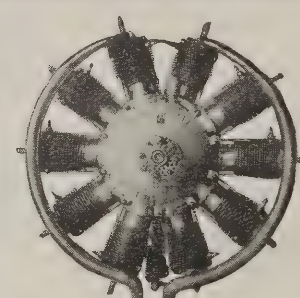
For Immediate Sa

Twenty-four makes:

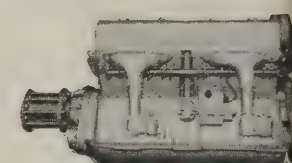
Anzani	BR-2	Hall-Scott	Lawrence
Beardmore	Clerget	A-7a	L'Aviateur
Benz	Fiat	Big Four type	LeRhone
Bugatti	Gnome	Hispano-Suiza	Liberty (Both 8 and

HALL-SCOTT





ANZANI



BUGATTI

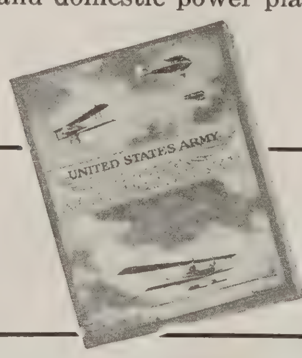
Prices Range from $50 to $600 per Single Engine (except Liberty Twelves)

Never before, and very probably, never again will there be such an opportunity to purchase aeronautical equipment under such favorable buying conditions as those afforded by this War Department Sale. The quality of the material is of the highest—the prices are unbelievably low.

For a striking instance—**a new engine as low as $100.00!** Many motors in excellent shape at $50 and $60! Practically every type of engine is included in the twenty-five different makes of foreign and domestic power plants.

And then there are the other offerings—plane some complete with motors; sea sleds at enormo reductions in price, hangars and all the great mi cellany of material that was gathered for t American Air Service in war.

Every item of the long list is of compelling inte est. You will find motors and other equipment fair condition quoted at figures lower than ne material. Send for the Catalog and get a compr hensive idea of the values.



Prompt Action Is Earnestly Advised

Write for the Descriptive Catalog.

Complete detailed descriptions of all materials offered, together with prices and terms of sale, are given in an illustrated catalog which will be sent to any person on request. WRITE FOR YOUR COPY TODAY.

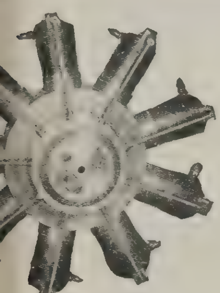
Sale of

UNITED S

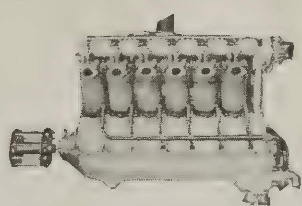
SURPLUS AERON

Engines

Maybach	**Opel**	**Thomas-Morse**
Mercedes	**Peugeot**	**Wright**
Oberursel	**Renault**	**Salmson**
Frankfort	**Sturtevant**	



GNOME



LIBERTY

nes, Engine Parts, Accessories, Sea Sleds and Hangars

l of 111 planes are offered—the following makes are
nted: Glenn Martin, Halberstadt Biplane, Nieuport,
G., Pfalz, Pomillien, Roland, Rumpler, Standard Stur-
Sopwith. While many are unserviceable and fit only
erimental and instruction purposes, some are complete
otors and can be made serviceable by careful over-
. Prices range from $100 to $1,000 for single planes.
alog for complete data.

iderable quantity of spare engine parts are offered and
such representative items as bushings and fittings;
ates, oil and water pump parts, magneto parts, pistons,
(crank and cam), valves and valve stems, springs,
etc. The accessories include tachometers, wheels,
ces, radiators, generators, fuel tanks, tires and tubes,

a sleds are a most attractive buy. Prices are at very
eduction—in one instance more than 80 percent of cost.
craft are all finely fitted and most of them are in
nt condition.

talog also gives details on hangars; on more than a
of a million aero spark plugs of best domestic and
manufacture and other items contained in the sale.

To The Speed Boat Enthusiast

Many of these engines have been converted by purchasers for use as regular marine engines, or as motive power for air driven craft. The catalog gives details, including the manner and cost of conversion to such uses.

S ARMY

TICAL EQUIPMENT

U.S. AIR SERVICE

Sale At Fixed Prices

Terms of Sale

All the material in this sale is offered at fixed prices which are plainly stated in the descriptive catalog furnished to all interested persons. The terms of sale are in no way involved and shipments will be made promptly. The terms of sale and everything the prospective purchaser might wish to know concerning the material is covered in the catalog.

Special Prices in Quantity

On the engines offered a special price will be given on quantities and where the purchaser buys the entire lot of a certain make of engine, all the spare parts for that engine will be included in the purchase at no extra cost.

All orders, requests for catalogs or information should be addressed to

MATERIAL DISPOSAL
and
SALVAGE DIVISION

AIR SERVICE
WAR DEPARTMENT
1616-G Munitions Building
Washington, D. C.

NAVAL and MILITARY AERONAUTICS

Army Review at Langley Field

Langley Field, Va.—Sixty-one planes of the First Provisional Air Brigade, nearly all of which shared in the bombing attacks on the ex-German destroyer G-102, were marshaled July 14 in review at Langley Field for the benefit of foreign naval attaches and Congressional and other guests of the navy.

The total number of army aeroplanes and airships of various types used in the operations against the G-102 was fifty-six and the average flying time for them all was two hours and forty minutes for the round trip from Langley Field to the target. All but three of the planes flew to the target and back without mishap. These three were compelled to make forced landings, but not one of them fell into the water.

Members of Congress, newspaper men and others in the reviewing party who wished, had an opportunity to ride in pursuit, light and heavy bombardment planes for a birds-eye survey of the Langley Field base. In an address to the visitors Colonel Milling told something of the ambitions of the army airmen for utilization of aircraft for coast defense. He said that while the Martin bombers were now able to carry a 2,000-pound high explosive bomb, a 4,000 bomb was being developed. The Martin bombers, which are generally called heavy bombers, would soon be shown to be light bombers. He predicted that in the event of a naval attack on the Atlantic coast, the army would be able to muster there within thirty-six hours all the planes east of the Pacific, and in less than twenty-four hours all the planes east of the Mississippi would be available for mobilization along the Atlantic.

Air officers thought the outstanding lesson from the destroyer attack was that more than fifty planes demonstrated their ability to fly to a point at sea ninety-seven and a half miles from base. Colonel Milling predicted that the army would be able to send planes out more than 150 miles from shore within a few years, with safety, for bombing attacks.

Among the visitors were Air Commodore Charlton of the British Embassy, Lieut. Commander Hubino, Japanese Naval Attaché; Colonel Vacarezza, Argentine Military Attaché; Lieut. Col. Guidoni, representing Italy, and representatives of the Brazilian and Cuban navies, and Representatives Sisson, Herrick, Davis, McClintock, Collins, Lineberger and Hamilton Fish, Jr., of New York.

Changes in Station of Air Service Troops

Orders were issued by the War Department transferring the following Air Service troops, effective June 30th:

From Kelly Field to Ellington Field, Houston, Texas:
- 1st Group Headquarters.
- 17th, 27th, 94th and 95th Squadrons.
- Air Park No. 2.

To Kelly Field, San Antonio, Texas:
- Flight "A," 90th Squadron, from Del Rio, Texas.
- Hqrs. and Flight "B," 90th Squadron, from Sanderson, Texas.
- Hqrs. and Flight "A," 8th Squadron, from McAllen, Texas.
- Detachment, 8th Squadron, from Laredo, Texas.
- Flight "B," 13th Squadron, from Marfa, Texas.
- Hqrs. and Flight "A," 13th Squadron, Hqrs. Detachment 1st Surveillance Group, and Photo Section No. 1 from El Paso, Texas.

(Three men will remain at each border station abandoned).

From March Field, Riverside, Calif., to Kelly Field:
- Detachment of 200 enlisted men, or such part thereof as may have six months to serve.

From Chanute Field, Rantoul, Ill., to Bolling Field, Anacostia, D. C.:
- One Staff Sergeant and 29 privates from School Detachment.

From Mather Field, Sacramento, Calif., to Ellington Field, Houston, Texas:
- Detachment of 200 enlisted men, or such part thereof available with at least six months to serve.

From Montgomery Air Intermediate Depot, Montgomery, Ala.:
- Air detachment demobilized and personnel, approximately 53 enlisted men, sent to Ellington Field.
- Four Staff Sergeants, 10 privates, 1st class, and 46 privates to Carlstrom Field.

From Selfridge Field, Mt. Clemens, Mich.:
- Supply detachment demobilized, and the four men sent to Scott Field, Belleville, Ill.

From Aberdeen Proving Ground, Md., to Mitchell Field, L. I., New York:
- Twenty unassigned privates, no men with less than 6 months' service to be sent. Casual detachment of two men from Governors Island, N. Y., to Mitchell Field.

From Rockwell Field, San Diego, Calif., to Post Field, Fort Sill, Okla.:
- One Staff Sergeant, one sergeant, one corporal, 25 privates, 1st class, and 275 privates; no men with less than 6 months' service to be sent.

Opening of Air Service R. O. T. C. Camp

The first Air Service Reserve Officers Training Camp opened at Post Field, Fort Sill, Oklahoma, on June 16, 1921, thereby marking an epoch of development in the Air Service preparedness program. There are thirty-one students at the camp—twelve from the Massachusetts Institute of Technology, five from the Georgia School of Technology, two from the Texas Agricultural and Mechanical College, seven from the University of Illinois, and five from the University of Washington. Students who are enrolled in the Air Service R. O. T. C. units at educational institutions, and who have completed two years of Air Service work are eligible for the camp if they are physically qualified to pass the 609 examination (medical examination to determine fitness for pilot duty).

At this advanced camp the students are taught aerial observation, and receive theoretical and practical instruction on the ground and flying experience in DH-4B planes as observers. The course of instruction lasts six weeks, and includes Visual Reconnaissance, Radio, Aerial Gunnery, Photography, Meteorology, trap shooting, infantry drill, and calisthenics.

The administrative personnel of the camp is composed of the officers attached to the six R. O. T. C. units who have been ordered to Post Field for this temporary duty.

New Navy Honorable Discharge Certificate

The new honorable discharge certificate which is now being distributed to ships and stations by the Bureau of Navigation, is handsomely engraved and printed on heavy paper of a parchment texture. Its striking feature is a reproduction of an engraving of the new type of battleship, the letters being in Old English and Script. A feature of the new certificate is the blanks on the reverse side allowing notations of service performed, the vessels, stations and service included, also campaigns and engagements in which the sailor participated.

Changes in Station of Officers

June 22, 1921—First Lieutenant Charles G. Brenneman, Air Service, ordered from the Aviation General Supply Depot, Washington, D. C., and directed to report to the Chief of Air Service, for duty in his office.

June 24, 1921—Major John C. McDonnell, Air Service, ordered from Aberdeen Proving Ground, Aberdeen, Maryland, to Ft. Sill, Oklahoma, for temporary duty at the advanced training summer camp; thence to proceed to Cambridge, Mass., for duty as Assistant Professor of Military Science and Tactics at the Massachusetts Institute of Technology, Cambridge, Massachusetts.

June 29, 1921—Major Earl L. Canady, Air Service, relieved from further observation and treatment at Walter Reed General Hospital, Tacoma Park, D. C., and ordered to Langley Field, Hampton, Virginia, for duty.

July 1, 1921—Captain Harold M. McClelland, Air Service, relieved from further duty as Student at Ft. Sill, Oklahoma, and directed to report to the Commanding General, Ft. Sill, for duty as Instructor.

July 2, 1921—First Lieutenant Eugene L. Vidal, Corps of Engineers, detailed to the Air Service and directed to proceed from Camp Humphreys, Virginia, to Carlstrom Field, Arcadia, Florida, reporting to the Commandant, Air Service Pilot School, for duty and pilot training July 28, 1921.

July 5, 1921—Major Roy S. Brown, Air Service, ordered from San Francisco, California, to Camp Benning, Georgia, to assume command of Air Service troops.

July 5, 1921—Captain Lewis A. Page, Air Service, relieved from further duty with the Air Service at Carlstrom Field, Arcadia, Florida, and returned to Infantry.

FOREIGN NEWS

Aircraft Material to Be Surrendered by Germany

On June 18 the Ambassadors' Conference, it is announced, decided that Germany must as soon as possible deliver up to the Allied Air Control Commission all aeroplane material manufactured contrary to the Boulogne decisions.

Everything described by the Commission as military material will be handed over to the Entente. Of the civil material only 25 per cent will be thus handed over. The remainder will go back to Germany as soon as the German Government is authorized to resume the building of aircraft.

French Customs Aerodromes

The Director-General of Customs announces that Customs clearance of seaplanes imported from abroad by the Mediterranean may be carried out at the Antibes station (S.N. Ae.). Seaplanes alighting from abroad may carry out Customs formalities at the Antibes station and the following Mediterranean ports: Mentone, Monaco, Villefranche-sur-Mer, Nice, Cannes, Saint-Raphael, Saint-Tropez, Marseilles, Saint Louis-du-Rhone, Cette, Port-Vendres.

French Aeronautical Gazetteer

The Governments of France, Belgium and Great Britain having agreed to compile Aerial Gazetteers of the aerodromes, seaplane bases and facilities for air navigation existing in their respective countries, the French Civil Aviation authorities have commenced the issue of Gazetteer sheets in the "Bulletin de la Navigation Aérienne." Sheets with regard to Valenciennes (Secondary Air Station) and Bayonne (Customs Seaplane Station) were issued in the "Bulletin" of April.

Palestine to Mesopotamia by Air, Via the Arabian Desert

A new air route has been opened up across the desert between Palestine and Mesopotamia, it is announced by the Air Ministry, and notification has been received of the arrival at Bagdad of three aeroplanes of the Royal Air Force, which have flown over this route. These machines formed part of a reconnaissance party that set out from Palestine on June 1, with the object of establishing a more direct line of connection between the existing aerodromes at Ramleh, in Palestine, and Bagdad, in Mesopotamia.

The length of the new route is about 590 miles, which is considerably shorter than the more northerly route formerly used. The line followed, which is an extension of the present Cairo-Ramleh route, starts from Ramleh, which is the main R.A.F. aerodrome in Palestine, passes through Amman, in Transjordania and Kasrazrak, where landing-grounds have been prepared, and proceeds thence in an almost straight line across the Arabian desert to Ramadie, on the Euphrates, and on to Bagdad. The last few intermediate ground stations for use in case of forced landings will be completed shortly. The distances between the principal stations are as follows:

Ramleh-Amman	65 miles
Amman-Kasrazrak	55 miles
Kasrazrak-Ramadie	400 miles
Ramadie-Bagdad	60 miles

The rest of the party traveled by cars, the aeroplanes co-operating with the ground detachment in selecting the most suitable air route. The landing-grounds chosen were then marked by the party for future use.

Coupe Deutsch

The eliminatory race for the French team to fly for the Deutsch Cup will take place on September 28 over 100 kilometers on the Cup Course: Villesauvage-La Marogue.

A Belgium Altitude Record

The Commission Sportive de l'Aéro Club de Belgique have confirmed, at the session held on the 13th inst., an altitude record for Belgium, established on the 6th inst., at Haren aerodrome, by M. Lovadina, who, on a 220 h.p. Ansaldo machine, reached an altitude of 7,907 m. (25,943 ft.). They have also presented him with the silver-gilt *plaquette* of l'Aéro Club de Belgique.

A French Height Record

From *l'Auto* we learn that Georges Kirsch created a new height record on June 14 last, when, on a 300 h.p. Nieuport (Hispano), he reached an altitude of 9,800 m. (32,153 ft.), thus beating the previous record, held by Casale, of 31,216 ft.

To India by Air in Six Days

Plans are now being made for a great flight by R36, England's latest and largest Airship, to Malta, Egypt and India. All sorts of proposals are being considered at this time, and instead of a trip to India it may be decided to make a non-stop journey to Malta and return. Should a decision be reached to make the trip to India, however, the R36 will make a stop in Egypt for replenishment of fuel. It is expected that the flight to India will take six days. The fastest time by rail and steamer is 21 days.

Dutch Aerodrome

The largest aerodrome in Holland has recently been established at Rotterdam, seven miles from the city. It is rather more than 1,100 yards long by 700 wide and, being perfectly flat and open, is well suited to the requirements of aircraft. A temporary railway has been made to bring gravel and other building material to the site, where a large shed has already been erected. Offices have been put up and premises for Customs, wireless, meteorological observation, a restaurant, and a tower for illumination by night are either already in existence or projected. The whole has been planned on data embodying the latest experience.

German Air Lines Run by Time Table

Germany has completely inverted the metaphorical expression, "It's all in the air," with its implication that the subject referred to is only a nebulous project, for Germany really is in the air, at any rate, its aeroplanes are there every day, and almost every hour of the day, according to a N. Y. *Times* correspondent.

A few days ago, feeling, so to speak, in a flighty mood, I called at the Travel Bureau, on the Unter den Linden. Within an hour I had been motored to an aerodrome outside the city, had been strapped into an aeroplane, and from 1,000 feet above was looking down on the white ribbon of road where I had been standing just before. That was a casual affair, improvised at a moment's notice, but if I had wished I could just as easily and with equal certainty have booked a place in an aeroplane the next day for any big city in the country.

On my desk is an aerial time table, so far as I know the first complete publication of its sort in history. Its mere existence, not to speak of its contents, is surely a striking witness to Germany's development of aerial transport. A substantial booklet of nearly a hundred pages, it is as matter of fact and substantial as Bradshaw's European Railway Time Table.

Fourteen pages alone are filled with the details of regular daily or twice daily services to places within the borders of Germany. They give to the minute the times of departures and arrivals. There is not even a saving clause about wind and weather permitting, so that it requires quite a mental effort to realize that before one are the pathless tracks of the air and not steel railroads.

By arrangements with Holland and other neighboring countries long distance services are linked up with England and Scandinavia. There is a map which shows at a glance the principal daily services inside Germany and their communications with overseas routes.

To this regular passenger transportation all sorts of subsidiary services are being added. The flying post, for instance, is rapidly developing, especially as it is not burdened with any special regulations apart from a slightly higher tariff. All one has to do to insure this speedy delivery is to mark the letter "by flying post," and drop it into any letter box in the ordinary way. In this matter, too, international arrangements have been made so that a letter posted in Berlin at 7:30 o'clock in the morning reaches London, for example, at 5:30 the same evening.

One interesting use of the aeroplane, to which special attention is directed, is for keeping the rest of Germany in swift touch with the lost territories, such as Danzig, or areas like Memel, whose fate is not yet determined, so that the populations of these districts shall not cease to imbibe the true gospel of Deutschtum.

Aeroplanes leave Berlin early every morning loaded with newspapers. Hydroplanes serve the same purpose for the Island of Sylt, off the coast of Schleswig, leaving Hamburg immediately on the arrival of the Berlin journals by train.

Reverting to the aerial Bradshaw, a glance at the advertisements reveals still further enterpirse. Here, for example, is the Hamburg-American line offering its own services to any town in Germany. It will send passengers or goods by special aeroplanes available to start at the shortest of notice. Another firm supplies aerial photographs, suggesting their particular desirability for enterprising financiers on the lookout for suitable sites for establishing new settlements and spas.

Unusual Italian Monoplane

An aeroplane capable of landing without the need of a large aviation field, able to rise without a long run beforehand, able to travel more than 300 miles an hour and, if necessary, to meander along at but a few miles an hour, is announced as the invention of an Italian engineer, Epaminonda Bertucci of Rome.

The inventor claims that he already tried out the machine on a small scale and regards his first experiments as indicative of the success of the invention. The new machine is primarily intended for aerial war chasing and is to be armed with a machine gun. It is a monoplane.

Touring by Aeroplane in Australia

Particulars have just been received from Australia of some extensive flights by an Avro machine fitted with a 100-h.p. Sunbeam-Coatalen "Dyak" engine. This machine is the property of Mr. P. Hogarth, of Richmond, North Queensland, who has purchased it for the greater convenience of visiting his large properties in Australia, and in view of the undeveloped nature of the country in many parts touring by motor-car or cart is scarcely practicable and an aeroplane is much more expeditious. Recently Mr. Hogarth took delivery of the machine at Sydney, and flew home, a distance of 1,845 miles, in 20 flying hours, averaging 92 miles per hour. Another machine of similar type has covered well over 10,000 miles in something like 150 hours actual flying time, and the only work necessary to be done on the engine was to grind the valves in twice. Both petrol and oil consumption were very satisfactory, and little doubt is felt but that the machines will prove thoroughly successful, and the example by Mr. Hogarth will be widely copied by the wealthy squatters of Australia.

Supply of Caproni Machines

Owing to the satisfactory results of a 600-h.p. Caproni the Government of Peru is ordering from Italy a second machine of the 300-h.p. type.

New German Air Mail Lines

According to a notice just issued by the German Postal Department there will, from July 1 on, be an air mail parcel service between Germany on the one hand and Holland and the Danzig and Memel districts on the other. (The Memel district, of course, is Eastern Prussian territory separated by Polish territory from the bulk of the country.) However, only urgent parcels will be admitted for transmission by air, an extra fee of 25 marks on the German-Dutch line, and 10 marks in the case of the Danzig and Memel lines, being charged for each kilogramme or fraction of a kilogramme. The custom-house formalities will be hastened as far as possible, so that parcels may in most cases reach their addresses on the very day they are dispatched.

German Air Mail Safety Service

The German Postal Department has made elaborate arrangements throughout its air mail lines to secure the safety of aircraft and their passengers and pilots. The Aeronautical Observatory at Lindenberg has been set apart as central office for all meteorological information, to which the observers on each air-line section at 8 o'clock every morning send a telegram comprising a number of figures from which all desirable data as to the meteorological condition at the place of observation can be derived. Places of observation are so chosen as to lie close to the dreaded weather limits, so that any danger to airmen may be detected as early as possible. The data communicated by postal officials are worked out at the Lindenberg Observatory as warnings for transmission to postal aircraft pilots. This weather service for the benefit of the air mail is entirely free of charge.

ELEMENTARY AERONAUTICS *and* MODEL NOTES

Early Aeroplanes

WHAT is regarded as the first machine built on aeroplane principles was built in 1843 by an Englishman named Henson. His machine consisted of a light framework of wood, 100 feet wide and 30 feet in length. The covering was of silk. A rudder shaped like the tail of a bird was used to steer it in a vertical direction. This rudder was fifty feet long.

Underneath the main wing (which was really a sail) a car was placed which contained the steam engine and the passengers. The machine was driven by two tractor propellers located on either side of the pilot. The engines were regulated to be adjusted to assist in turning to the right and left. The engine gave twenty horsepower. While Henson's design showed much promise of success, the horsepower and the type of propeller used were entirely insufficient for flight.

The Phillips' Aeroplane

A flying machine of curious form was constructed in 1862 by Horatio Phillips, also an Englishman. In this machine a number of narrow surfaces with long leading edges were carried in a frame in somewhat of the manner of Venetian blind. The height was 9 feet, 3 inches and the span was 21 feet, 8 inches. The entire machine was mounted upon a wheeled carriage, shaped like a boat, and 25 feet in length.

The machine was operated over a circular board track, 600 feet long. The machine was anchored by a rope to the middle of the track. The weight was under 300 pounds. Experiments showed that a load of 72 pounds placed above the front wheels could be lifted 30 inches in the air. These experiments proved that the construction principles were correct, but after a few experiments of this sort the work was abandoned.

Maxim's Steam Engine Aeroplane

Some very interesting experiments were carried out by Sir Hiram Maxim in 1888, whose large aeroplane cost more than $100,000. His machine had a large sail or plane with a number of smaller wings at either side of it. The combined area of all the wings was 3,875 square feet.

A framework built of thin steel tubes connected the wings to a platform measuring 40 feet by 8 feet. This framework formed a support for the boiler and engine. The vertical movement of the machine was controlled by two horizontal planes, one placed at the front and one at the rear. The horizontal control was managed by two planes inclined to one another at an angle of 7.5 degrees, and arranged so that they could be raised and lowered with a resulting shifting of the center of gravity, causing an alteration of the flight.

Its weight complete was 7,000 pounds. For purposes of testing it was mounted on two pairs of wheels set on a railroad track. An additional rail was placed above the machine to control the upward movement.

Propellers were 17 feet, 6 inches in diameter. When the steam pressure in the boiler reached 350 pounds pressure enough power was generated to cause the machine to rise from the lower rails and come in contact with the upper one. During one of the tests the upper rail was broken away and the machine flew across the field, landing in such a way as to cause its partial destruction. A dynamometer test showed that a weight of 5,000 pounds would have been lifted, truly a remarkable performance for that early date.

Other Early Planes

At the Paris Exposition in 1900, a machine devised by a well-known French engineer, named Adder, was exhibited for the first time. Its planes or wings could be folded back; they were like a bat's wings. Two four-bladed propellers were used, driven by a compressed-air motor.

Although this plane weighed more than 1,000 pounds, it could lift itself from the ground and make short hops.

Another machine built by Kress was tested in Austria in 1901. It showed promising results. The experiments of Professor Langley, at Washington, D. C., resulted in the first flight of a heavier-than-air craft of more than a mile, on December 12, 1896.

The problem of soaring flight was being studied by Otto Lilienthal, a German, the Wright Brothers, Chanute and Herring, Americans. The results of these tests proved of great value in power-driven flights later on. It was in 1903 when the Wright Brothers built their glider which was equipped with a gasoline engine. Their progress from that time on was very rapid for they had gathered considerable useful information which was kept secret for a long while and it was not until later that it was realized that they had progressed so far beyond their contemporaries.

Air Resistance

Careful experiment has proven quite conclusively that air resistance increases as the square of the velocity. This means that at ten miles an hour the resistance of the atmosphere is four times what it was at five miles an hour. At a speed of fifty miles an hour (10 times the speed of five miles) the air resistance is 100 times as great. The wind pressure is approximately 50 pounds per square foot when moving at the rate of 60 miles an hour. From this basis, the indication of almost any speed can be found to a reasonable degree of accuracy.

The table below gives the work required to move a body through the air per square foot of "frontal area" or surface exposed at right angles to the flight path, and should assist those who desire to calculate the resistance of any kind of aircraft:

Miles per hour	Feet per second	H. P. required per sq. ft.
10	14.7	0.013
15	22	0.044
20	24.6	0.105
25	36.7	0.205
30	44	0.354
40	58.7	0.840
50	73.3	1.640
60	87.9	2.830
80	117.3	6.720
100	146.6	13.120

Illinois Model Aero Club Notes

The semi-annual election of officers of the Illinois Model Aero Club was held on July 1st. The following is a list of officers elected and re-elected at that time:

President, L. Chatroop; Vice-President, H. Wells; 2d Vice-President, W. Brock; Secretary, R. Jaros; Treasurer, L. Davies; Corresponding Secretary, B. Pond; Contest Committee Chairman, W. DeLancey.

These new officers, as well as all the other members of the I. M. A. C. have pledged themselves to do all in their power for the advancement of model aeronautics. This pledge has been lived up to as shown by the flying records of the members whose flights have been made with real consistency.

Although the I. M. A. C. is not conducting a particular membership campaign at the present time, several of the old members are leaving for out-of-town universities, etc., and this leaves quite a gap in the membership rolls. An opportunity is therefore called to the attention of young men near Chicago who are interested in model flying, as the I. M. A. C. will welcome new members to fill up its ranks.

The I. M. A. C. will be represented at Chicago's "Pageant of Progress" Exposition, and model fliers visiting there are invited to become acquainted with the Club's representatives.

A-E-R-O-N-I-T-I-S

The Song of the "Jennie"

Tune of "Oh Johnnie"

Oh! Jennie, Oh! Jennie
How you can fly!
Oh! Jennie, Oh! Jennie
You take my eye.
You've got the others beat a mile,
Although you're not so much for style.
Oh! Jennie, Oh! Jennie
You'll do to fly
Because you are so very safe.
Oh, you're fast it is true
But when I climb in you
Then it's Oh! Jennie, Oh! Jennie Oh!

Lawrence Russell, Age 14, *Omaha, Nebr.*

Rather Fishy

There was a young fellow named Fisher,
Who was fishing for fish in a fissure,
When a cod, with a grin,
Pulled the fisherman in:
Now they're fishing the fissure for Fisher.

Cause Enough

Smith: What is the matter with Brown? Every time he sees an aeroplane he trembles and grows pale with fright.

Jones: Oh, his wife eloped with an aviator.

Smith: And when he sees a machine in the air the recollection causes him pain?

Jones: No, no! He's afraid it's bringing her back.

Not Possible

When a lady who was "burning up the road" on the boulevard was overtaken by a traffic officer and motioned to stop, she indignantly asked: "What do you want with me?"

"You were running 40 miles an hour," answered the officer.

"Forty miles an hour? Why, officer, I haven't been out an hour," said the lady.

"Go ahead," said the officer. "That's a new one on me."

—*Pittsburgh Dispatch.*

THE AEROPLANE IN AFRICA

Giraffe: "Here you, be careful where you're going. The next time you hit me in the neck I'll bite you."

He Knew

Deacon—Do you know anything about parts?

Choir Leader (*formerly automobile mechanic*) Sure. The soprano needs a new valve and the bass ought to have his exhaust fixed.—*Judge.*

Sentry Story No. 198,700

As in every other sentry story, the new recruit was doing guard duty for the first time. In the wee, sma' hours, there was a rattling that might have come from machine gun bullets but really came from milk cans (because this happened on Long Island). The milkman drove by.

"Halt!" yelled the sentry.

"Who's there?" inquired the milkman.

"Why—why—that's what I got to say," retorted the guard agitatedly.

Up to Him.

He: "Are you a widow?"

She: "Yes."

He: "My, but you have beautiful eyes!"

She: "If you don't stop your flirtation, when I get to heaven I'll tell my husband."

He: "Suppose he isn't there?"

She: "Then you tell him."

A certain private was called before Capt. Wright, Summary Court Officer, charged with a minor offense.

"Have you ever been tried before?" gruffly asked the S. C. O.

"Yes, sir."

"What was the nature of your offense?"

"Well, sir, I don't think there was any offense, but there was a new Summary Court Officer and I think the C. O. wanted to give him some practice."—*Fly Leaf.*

She Knew

Violet: "You have been making love to some other girl!"

Red Davis: "How do you know?"

Violet: "Because you have improved so."

Grand Finale

Two dusky soldiers, who had learned the manly art in the A.E.F., were putting on a farewell bout at the demobilization camp. As they advanced to the center for the preliminary handshake, one said:

"Yo' bettah git ready fo' de mawnin', man, 'cause when dey blows reveille yo' ain't gwine be round fo' breakfast."

"Huh!" retorted the other scornfully. "Dey is gwine play reveille all right, but yo' ain't gwine hear it. De las' moosic yo' hears is de taps Ah's gwine serenade yo' with."

—*American Legion Weekly.*

The Doctor: And if he loses consciousness again, give him a teaspoonful of that brandy.

The Patient's Wife: While he's unconscious? Sure, Doctor, he'd never forgive me.—*Life.*

An Exception to the Rule

Hokus: A man never gets anywhere by just letting things slide.

Pokus: How about the trombone player?

Mack—What's funnier than a one-armed man trying to wind his wrist watch?

Knutt—A glass eye at a keyhole.—*Lehigh Burr.*

First Gob: "Go much to the theater?"

Second Gob: "Considerably."

First Gob: "Ever see 'Oliver Twist'?"

Second Gob: "No; but I have seen Fatima wiggle."

Sure to Miss

The scion of the family had acted so badly that punishment of some sort was necessary.

"Ernest," commanded his mother, "find a switch and bring it to me."

Shortly afterwards the bright young man returned.

"I couldn't find a switch, mamma," he reported, "but here's a stone you can throw at me."—*American Legion Weekly.*

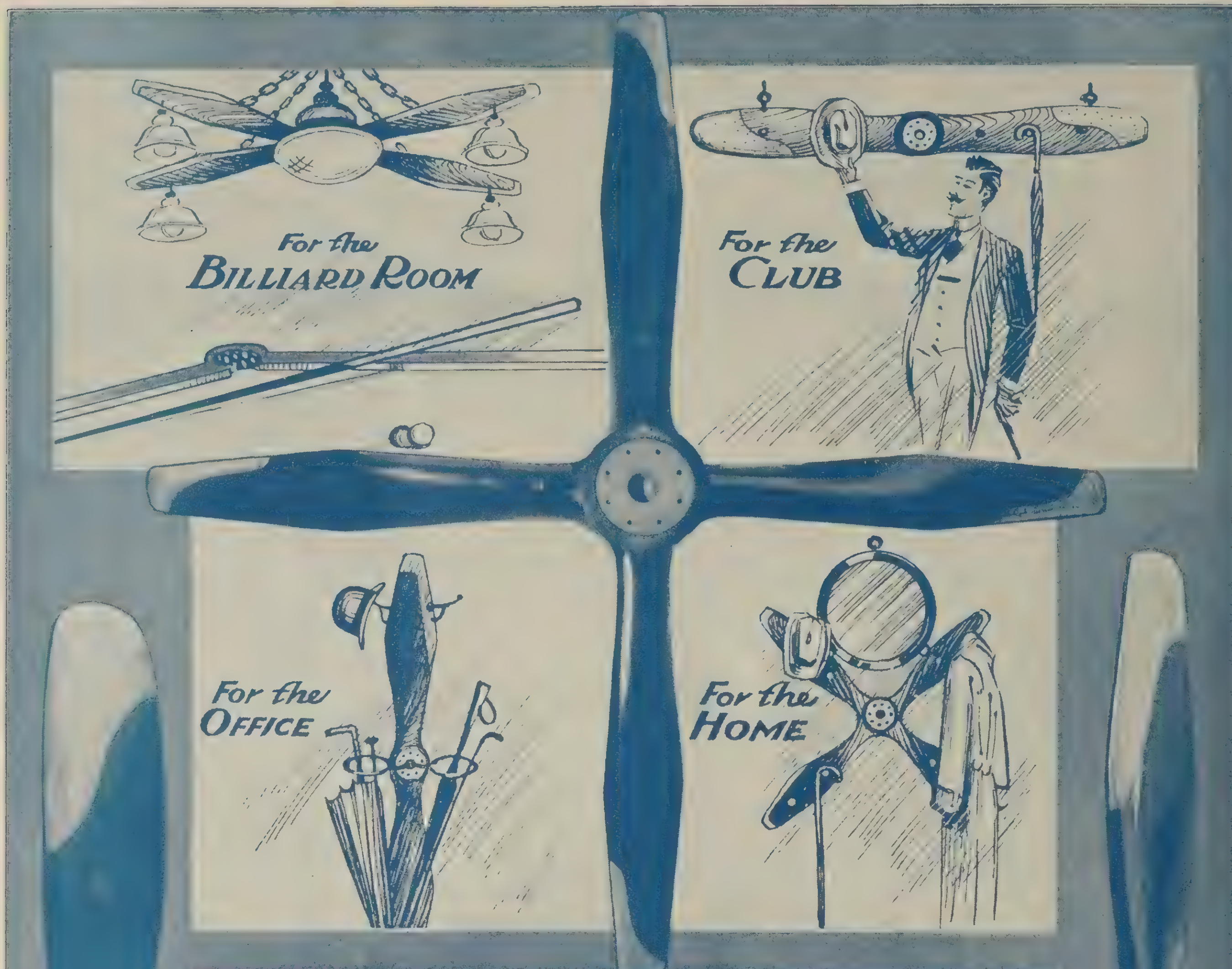
AERIAL AGE WEEKLY

OL. 13, No. 22 AUGUST 8, 1921 10 CENTS A COPY

The Remington-Burnelli 30-Passenger Airliner Making a Landing

Delay of City Authorities Causes Rockaway Station Abandonment

LISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY


For the
BILLIARD ROOM
For the
CLUB
For the
OFFICE
For the
HOME

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIII NEW YORK, AUGUST 8, 1921. NO. 22

Delay of City Authorities Causes Rockaway Station Abandonment

AFTER New York City's Sinking Fund Commission had repeatedly postponed action on the request of the Navy Department that about forty acres in Jacob Riis Park be ceded as a permanent site for the Rockaway Air Station, Secretary of Navy Denby directed the commanding officers at the station to prepare to cease activities there on September 1. Final action on the proposal for a permanent site at Rockaway Beach had been postponed to November by the Sinking Fund Commission.

The closing of the Rockaway Air Station leaves the entire Atlantic Coast north of Hampton Roads without an air station, the posts at Chatham, Mass,, and Cape May, N. J., already having been closed by order of the Department. Naval officers had told the Sinking Fund Commission that the Rockaway site was the best strategic site for the protection of the city and urged that the city enable the Navy Department to build a permanent station.

The order received by Commander D. E. Cummings, commandant of the station, was signed by the Secretary of the Navy, and read as follows:

"It is purposed to place the air station under your command on a non-operative basis as soon after September 1 as practicable, pending final decision by the department. Stop operations except for tests. Order no material necessary after September 1. Make plans and preparations for the disposition of material, extend money allotted as far as practicable in closing up station."

The thirty officers and 250 enlisted men at the Air Station will be assigned to other stations, or to other duties in the navy, and by Winter the Air Station will be deserted. The ten seaplanes and the two blimps and other aircraft at the station will be flown to other posts, in accordance with future orders from the Navy Department, and all the hangars and barracks will be closed up, with only a few men on duty to guard against fire and theft.

During the war the Rockaway Air Station was one of the largest of the temporary air stations and was not merely used as a patrol base, but also as a repair yard for craft with the Atlantic fleet and for the testing of new planes and balloons. Its machines patrolled the entire New York Harbor and all along the coast and Long Island Sound from Cape May to Montauk Point. A pilot taking to the air at this station was able to watch vessels passing to and from the ocean without going out of sight of his own hangars.

Here the historic NC transatlantic expedition tuned up its planes for the hop across the sea, and the planes took off at the Rockaway runways for their first leap to Halifax. This was also the home station of the free balloon that carried Lieutenants Walter Hinton, Stephen Farrell and A. L. Kloor into the Canadian wilderness. The C-5 also started from this station on its unsuccessful transatlantic attempt and was blown to sea at St. Johns.

Only one other station had hangars large enough for the NC planes. The Rockaway Air Station has two of these large hangars, with smaller hangars for the other seaplanes and a big hangar for lighter-than-air craft. It has wooden barracks for about 300 men and fifty officers, all of temporary construction.

The site of forty acres during the war accommodated as high as 800 officers and men and eighty planes, and pilots who had finished their training there were assigned to other stations.

During the last year many important tests of aircraft have been carried on at the station with the D-6, the largest dirigible, as well as with lighter-than-air craft built so that they could be towed at sea by destroyers or mother ships. Much material also has been stored at Rockaway.

Officers at the station had reports several days ago that they would be transferred soon, and that the station probably would be closed, and some of them expressed the unofficial opinion that the failure of the city to cede the site might have had something to do with the navy's plans. Some of these officers have pointed out to the city the strategic value of the site.

The News of the Week

Denby Wants 30 Million For Plane Carriers

Washington.—Recommendation that approximately $30,000,000 be appropriated for construction of two aeroplane carriers will be made to Congress in the near future, Secretary of the Navy Denby announced July 25. A measure embodying such a proposal is pending before the House Naval Committee, and it is understood that the Naval Secretary will urge its speedy enactment.

Coincident with Mr. Denby's announcement, Senator King, Democrat, Utah, introduced a bill which would provide for conversion of the battle cruisers Saratoga, Lexington and Constellation into aeroplane carriers, and for stoppage of construction work on the battleships South Dakota, Indiana, Montana, North Carolina, Iowa and Massachusetts and on the battle-cruisers Ranger, Constitution and United States.

Secretary Denby said he had decided on his forthcoming recommendation even before the recent bombing tests, but that the results of those tests had convinced him that the navy needed more aeroplane carriers. Senator King, addressing the Senate in behalf of his bill, said that the bombing tests had demonstrated conclusively that "too much importance" had been attached to capital ships and too little attention devoted to aircraft and submarines.

Secretary Denby indicated that in his opinion it would be wise to construct two new aeroplane carriers, one for the Atlantic fleet and the other for the Pacific forces. Two carriers were provided for in the current naval appropriation bill as it passed the Senate, but the House refused to accept the provision and it was stricken out.

The Los Angeles Tournament

At the International Air Tournament held at the Los Angeles Speedway July 16th and 17th, the feature event of the meet was the Curtiss Cup Race which was open to planes equipped with a Curtiss OX-5 motor which passed an elimination speed test of 100 miles per hour. This race was won by the Pacific Standard Model C1.

This plane was specifically designed by O. W. Timm and built in the factory of the Pacific Airplane & Supply Company and attained a maximum speed of 137½ miles per hour in its elimination tests and averaged 105⅗ miles per hour in the race, which was held over a hair pin turn course, around pylons situated 1 mile apart.

In the construction of this plane the elimination of head resistance was the prime factor. In every possible way resistance was overcome. A modified U. S. A. 27 wing curve was used, making it possible to eliminate all external braces, struts and wires. The fuselage is made entirely of laminated wood, highly finished and perfectly streamlined.

The Pacific Standard Model C1 was built by the Pacific Airplane & Supply Company as an experimental job for commercial racing and to bring before the Government a new type of scout training plane. Emery H. Rogers, President of the Pacific Airplane & Supply Company, piloted the plane in the Curtiss Cup Race, and emphatically states that in his entire experience he has never handled a machine which was so easy on the controls and so quick to respond to the control action.

Nelson Meet a Big Success

The Nelson, Nebraska, Aviation Meet which closed July 16th, proved to be one of the biggest and best Aero Meets in that section of the country. The meet drew approximately 25,000 people the three days. Pilots Smith, Cochran, Weaver, Beach, Wagner and Friday were winners and carried home cups. DeForest Swanson, manager of the Central Aircraft Company, and who had charge of the Holdrege Meet last May, had charge of the meet.

Brief News Notes

A Commercial Aero Exposition is to be held in the City of Mexico, in September.

The Aero Club of America is planning to have flying activities at Hazelhurst Field in the near future.

The Aero Club of America has started out on a National Campaign for Membership for the support of Aeronautics.

New York City "Wiped Out" in Big War Game

New York was totally destroyed and eliminated as a military factor July 30, theoretically speaking, when an "enemy" bombing fleet comprising one Handley Page, one Caproni and fifteen Martin aeroplanes, under the direction of Brig. Gen. William Mitchell, Assistant Chief of Air Service, dropped twenty-one tons of gas, flame and fragmentation bombs over the lower city in two raids. Although General Mitchell refused to be quoted, an officer of high rank said that the air service had successfully demonstrated the defenselessness of New York and other Atlantic seaboard cities.

The attack was part of a tactical problem which the air service had been working out since the sinking of the Ostfriesland last week. In this case, the flyers were turned into an enemy raiding force with orders to pave the way for the landing of a hostile army from overseas.

The theoretical situation leading up to the capture of New York was as follows: War had been declared by a foreign power on July 15. Six days later two hostile forces engaged with each other at a point seventy-five miles east of the mouth of Chesapeake Bay. The only aircraft with our navy were a few seaplanes and unarmed training planes, which were quickly shot down by a greater number of enemy aircraft. The Red air force followed with an attack on the entire Blue (United States) fleet, ending in the sinking of the last of our battleships on the Atlantic coast.

On July 22 the Red air raiding force landed from the carriers and established an air base at a point eight miles north of Cape Hatteras. Operating from their airdrome, the aviators in night attacks destroyed our planes centred at Langley Field, Va., and the Norfolk Navy Yard. This sustained the position of the enemy as far as interference by land and sea was concerned, and enabled them to be within striking distance of the remaining air stations at Bolling Field, outside of Washington, and Mitchel Field, near Garden City, L. I. On the 24th Richmond, Va., was destroyed, and in succeeding attacks Newport News and Norfolk.

The commander of the enemy forces then ordered the attack on New York. The squadron, led by the giant Caproni, and with a crew of about seventy men, distributed among the raiding planes, swung over lower Manhattan in the first attack shortly before noon. Flying at an average height of 8,000 feet, plane after plane released the theoretical 1,100 and 2,000-pound fragmentation bombs, as well as those of the flame and gas variety. The effect of the gas bombs was felt as far at Times Square, according to the air officers, and those of the inhabitants who survived their deadly effect were scurrying towards Yonkers.

Returning from the second attack, the planes flew at a close range, and the raiders picked out such buildings as the Woolworth Building, the Sub-Treasury and the Custom House as their especial targets. The planes hovered at 5,000 feet.

The destruction of the lower city having been completed and the inhabitants either killed or fleeing, the Reds turned their attention to the elimination of the Brooklyn Navy Yard, following which they flew to Mitchel Field. Last night the pilots and enlisted men were given leave until Monday to visit the city they had "destroyed." The Reds also were to have attacked Philadelphia, but deferred the destruction of that city until next week.

The flyers said that ideal weather conditions obtained. Low visibility at the height at which the attacking air force flew would have made the planes difficult targets for anti-aircraft batteries. On the other hand, the raiders had little trouble in picking out their targets, the aviators said.

The force under General Mitchell was divided into two heavy bombing squadrons commanded by Major Leo Walton and Major T. J. Hanley. There also was a pursuit group under Captain B. B. Baueus. A Thomas Morse scout plane, which proceeded the bombers at one stage of the flight, attained a speed of 170 miles an hour.

Advocates of a bigger air force cited the "attack" as vividly illustrating what might take place should an enemy force eliminate our air forces. If seventy men in only seventeen planes could do all this, much greater damage and destruction would result from a larger force, they pointed out. The pertinence of the attack on New York in view of the recently announced abandonment of the Rockaway Point Air Station also was pointed out.

New Rules Prohibit Army "Stunt" Flying

Washington.—Aroused by the fatal accidents occurring as the result of aeroplanes doing "stunts" over holiday crowds, the War Department has issued general orders restricting flying over towns and prohibiting "stunt flying" over crowds except under unusual conditions. Practically the same general rules apply to lighter-than-air craft.

Except in taking off from fields located

in or near thickly populated areas, the general order provides that planes will be so flown that the line of flight and altitude will be such as to permit them to glide with a dead motor to a safe landing without danger to persons or property on the ground.

The paragraph dealing with "stunt flying" in the general order reads:

"Acrobatic flying over cities, towns or populous districts or over assemblages of persons gathered on the borders of flying fields to witness demonstrations is forbidden."

It is provided, however, that these restrictions may be departed from when the mission prescribed by proper authority requires low altitude flying, in which case special precautions must be taken to see that the plane functions properly.

Free balloons are prohibited from flying over populous localities with a drag rope loose, and "drag-roping" is permitted only for training or emergency purposes and then only over open country. The use of balloon anchors over populous areas is absolutely prohibited, their use being restricted to forced landings, inclement weather conditions and for training purposes.

The following rules are laid down for flying over assemblages of people, including people gathered on foot and in vehicles around the borders of flying demonstrations:

1. Flying prohibited below an altitude of 1,000 feet, except in taking off. Plane must be flown in a position from which glide with dead motor can be made to safety.

2. Strict inspection of every part of plane at least one minute immediately before taking the air for each flight.

3. Before taking off and before landing, pilots must assure themselves that landing field is clear.

While the new orders apply only to army fliers, it is expected that some such rules will also be adopted by other branches of the Government maintaining air activities.

Plan to Keep World Informed on ZR-2's Transatlantic Trip

London.—Lieutenant Clifford A. Tinker, U. S. N., has arrived here and is arranging with the Air Ministry the plans to keep the United States and Great Britain informed of the experiences of the big dirigible airship ZR-2, formerly the R-38, which has been purchased by the United States Navy from Great Britain, during its flight to America.

The start of the flight is expected to take place in the middle of September.

Many aviators, magazine writers and other persons have sought permission to take part in the voyage across the Atlantic, but Secretary of the Navy Denby has cabled that no correspondent or any "non-military" passengers will be permitted on the trip.

Aviator Lands on Mont Blanc

Paris.—A French aviator has accomplished the difficult feat of landing on the top of Mont Blanc and flying away again.

On July 30 at 6:15 o'clock Lieutenant Durefour of the French army started from a field near Lausanne and at 7:05 landed on top of the peak at a height of 15,782 feet.

He got out of his machine, walked around for ten minutes, then took to the air again. Twenty minutes later he landed safely near Chamounix.

Flier Saved by Nerve When Wing Collapses

Several hundred persons, including Brig.-Gen. William Mitchell and other officers, were thrilled at Mitchel Field July 30, when Lieut. A. O. Doolittle by skilful manœuvring saved himself from what appeared to be certain death.

Lieut. Doolittle was flying a fast scout plane. While coming out of a loop about 300 feet from the ground, he discovered the trailing heads of the plane had collapsed, causing it to wabble. Then one wing collapsed. He was unable to turn the plane, but he remained cool and managed to land on an even keel in soft dirt. The plane was wrecked, but Lieut. Doolittle escaped injury. He immediately made another flight in a machine of the same type.

Line Officers Must Be Prepared on Aviation

In view of the realization of the important part aircraft operations are destined to assume in naval warfare of the future, it is planned to require that all officers of the line of the Navy, besides those that make a specialty of aviation, shall have a good working knowledge of aeronautics.

As a step in this direction, an order is about to be issued by the Navy Department requiring all the officers after January 1 next, to be prepared, on professional examinations, for promotion up to the grade of lieutenant commander, to answer questions on aeronautics, questions to be included in the examination now are being prepared in the aviation section of the officer of the chief of naval operations.

Midshipmen at the Naval Academy are being given elemental instruction in aircraft engineering and operation, and it is planned during the next term to extend the curriculum in that particular. The academy at present is equipped in its engineering department with various types of aircraft motors and two aeroplanes are stationed there, where the equipment is available particularly to those assigned to postgraduate instruction in aeronautics, as well as to the midshipmen.

Officers regularly are being assigned to the Naval Air Station at Pensacola, Fla., for six months' primary course in aeronautics. The course includes ground instruction in aircraft construction and engineering, navigation and tactics and flight training for qualification as pilots and observers and for proficiency in bombs, torpedoes, etc., and some officers also are trained in lighter-than-air craft. Following that course, selected officers are assigned to post-graduate instruction in aeronautical engineering, which includes one term at the Naval Academy and another year at Massachusetts Institute of Technology.

To Attempt Polar Flight

Washington.—Plans for a trans-polar flight in September from Point Barrow, Alaska, to Spitzbergen and the North Cape, Norway, were announced August 1 by Edwin Fairfax Naulty, of New York. Scientific observation of ocean, air and ice currents will be the chief purpose of the trip, Mr. Naulty said, with the hope of establishing the feasibility of a new route for commerce as a secondary consideration. The distance is approximately 2,500 miles.

As announced, the start will be made from Seattle with a convoy of several planes, which will proceed by easy stages up the Alaskan coast to Point Barrow, stopping at Ketchikan, Anchorage and Nome. The Arctic flight will be made by one plane, which already has been constructed, carrying four men, including Mr. Naulty. The other three are former service men. It was said their names would be announced soon.

Originally, it was explained, it was the intention to make the flight next year, but reports of warm weather near the Arctic Circle had led to the advancing of the date.

"We plan to make the flight as early as possible," Mr. Naulty said, "and, strange as it may seem, to do it in late September. There are good reasons for the choice of this time. Our flight speed we estimate will be about 100 miles an hour, to which might be added the speed of a following air current."

Fuel was conceded to be the chief problem. A supply ample for fifty hours of continuous flight will be carried, it was said, and those planning the attempt expressed the belief that this would furnish an excess which would permit short by-flights at the first landing place on the polar ice and at the Pole itself.

If the first flight is successful others will be undertaken at once.

The Sport-Farman finds much favor amongst women flyers. The picture shows Mrs. H. R. Tucker, of Fairmont, West Virginia, initiating a girl friend to the pleasures of flying. She is the wife of Harrison R. Tucker, of the Southern Airplane Co. Farnham distributors, and has made a number of long cross-country flights with her husband

The AIRCRAFT TRADE REVIEW

The Cox-Klemin Aircraft Corps Organized

Capt. Charles Cox and Alexander Klemin have established a fully equipped plant at College Point, L. I., for the construction of aircraft.

The concern will be known as the Cox-Klemin Aircraft Corporation, and will undertake the design and construction of special aeroplanes for every purpose.

The company has taken over the engineering organization of Alexander Klemin and Associates, and has started construction on an order of five six-passenger twin engine monoplanes, an amphibious design for a Pennsylvania capitalist.

Capt. Cox, the President and General Manager, is a capable business man, and experienced pilot.

Alexander Klemin, Vice-President and Chief Engineer, is considered an authority on aeronautics in this country, and for the past two years has been Consulting Engineer to aeroplane companies and the Government.

The factory manager is Mr. Frank W. La Vista, who, for the past six years, has been associated with the L. W. F. Company. Mr. La Vista is a capable constructor, and, no doubt, will be very successful in his new position.

Conference Against British Air Service

London.—One of the matters discussed by the Imperial Conference in London has been the possibility of using airships as a method of improving communications between the mother country and the far-flung Dominions of the British Empire. A committee was appointed to report on the subject, and its unanimous decision is that any scheme of the kind would be too costly.

The Dominion Premiers and the British Government have to decide whether they will go shares in maintaining British airships and their personnel as the nucleus of a great imperial trans-oceanic air service. The committee estimated that it would require an expenditure of £10,000,000 to run an airship service for five or six years, and it came to the conclusion that from the commercial point of view the experiment would not be worth the expense, especially when the present financial situation was considered.

Manufacturers Aircraft Association Elects Officers

J. K. Robinson, Jr., president of the Gallaudet Aircraft Corporation, East Greenwich, R. I., was elected president of the Manufacturers Aircraft Association, Inc., at the annual meeting of the Association, 501 Fifth Avenue, New York City, July 28. G. M. Williams, general manager of the Dayton Wright Company, Dayton, Ohio, was elected vice-president; F. H. Russell, vice-president of the Curtiss Aeroplane and Motor Corporation, Garden City, N. Y., secretary, and F. B. Rentschler, president of the Wright Aeronautical Corporation, Paterson, N. J., treasurer. In addition to these, there were elected to the Board of Directors the following: A. H. Flint, L. W. F. Engineering Co., College Point, N. Y.; I. M. Uppercu, Aeromarine Plane and Motor Co., Keyport, N. J.; Glenn L. Martin, Glenn L. Martin Co., Cleveland, O.; F. L. Morse, Thomas-Morse Aircraft Corp., Ithaca, N. Y.; and Col. J. G. Vincent, Packard Motor Car Co., Detroit, Mich. S. C. Bradley was reelected general manager and assistant treasurer.

Rickenbacker Organizes Auto Co.

Detroit, July 30.—Captain Edward V. Rickenbacker, world famous as America's ace of aces during the war and before the conflict with Germany one of the foremost race drivers in the United States, has entered the automobile manufacturing field in association with B. F. Everitt and Walter E. Flanders. The announcement has caused much comment in the motor car industry.

The Rickenbacker Motor Company is the name of the new corporation, which is capitalized at $5,000,000. The officers of the organization will be: President and general manager, B. F. Everitt; vice-president and director of sales, Edward V. Rickenbacker; secretary and treasurer, Harry L. Cunningham; board of directors, B. F. Everitt, Walter E. Flanders, Edward V. Rickenbacker, Harry L. Cunningham, Carl Tichenor, Roy Hood and E. R. Evans.

The Rickenbacker car is to be made in Detroit.

Inquiry Will Disclose Engine Ideals

WASHINGTON.—Information of great value in designing aeroplane engines in the United States is promised by the Bureau of Standards in forthcoming final reports to be made in connection with a thorough investigation that has been completed as to the performance of two well-known makes of German Aeroplanes. The investigation was made through co-operation between the Bureau and the Air Service at McCook Field.

The two engines which have been investigated are known as the B. M. W., 185 hp., and the Maybach, 300 hp. Both machines are of the 6-cylinder type which has long been a favorite in Germany.

It may be of interest to note, the Bureau reports, that the performance of the B. M. W. engine at high altitude was excellent, its low fuel consumption being the outstanding feature of merit. The chief point of interest in connection with the Maybach was the design of the carburetor, which, however, cannot be considered as entirely satisfactory as, although it gave excellent economy of fuel, the efficiency of the engine at part load was rather poor.

Kansas Aviation Meet

An Aero Meet and Show will be held at Concordia, Kans., on August 11, 12 and 13 and already twenty pilots have indicated their intention of competing in the various events.

Free gas, oil and hotel accommodations are to be supplied to participating pilots and a banquet for all of the contestants will be a feature of the closing night.

Lund with Pioneer Instrument Co.

Nels B. Lund has joined the Pioneer Instrument Company as assistant to Chief Engineer M. M. Titterington.

Mr. Lund is a pioneer in the design of aircraft instruments and gyroscopic apparatus, having been associated with the Aircraft Instrument Department of the Sperry Gyroscope Company in 1917, 1918 and 1919. He has also had a broad experience in the design of delicate instruments and special apparatus of many kinds.

The assistance of Mr. Lund in the Engineering Department will permit Mr. Titterington to devote a larger part of his time to experimental and development work.

Washington Aero Engineers to Open New York Office

New York.—An agreement has just been effected between the firms of A. & D. R. Black, Washington, D. C., and Alexander Klemin and Associates, New York, by which the former will take over the offices at 22 East 17th Street, New York, to be vacated by the latter firm upon removal of its staff to the plant of the Cox-Klemin Aircraft Corporation, College Point, N. Y.

On account of the taking over of Mr. Klemin's organization by the Cox-Klemin Corporation certain classes of inquiries (particularly in the consulting field) which he will no longer be in a position to handle will be referred to A. & D. R. Black.

As a part of these changes the Black firm will remove its head office from Washington to 22 East 17th street, New York, on August 15th. Its present office in the Evening Star Building, Washington, will be continued as a Washington branch.

Aerial Patrol of Sea Lanes

Acting Secretary of the Navy Roosevelt has asked the House Committee on Naval Affairs to include in the Legislative Naval bill for 1921 a proviso "that naval aviation shall have cognizance of the aerial operations necessary to gain and exercise command of the sea and of such stations and craft as are necessary to insure adequate aerial patrol of the sea lanes for these purposes." Under existing law dividing aerial responsibility between the two Services, the Navy is not charged with keeping open the sea lanes for coastal shipping. This, says Mr. Roosevelt, "is an integral part of the Navy's duty and was the major work it performed in aviation during the late war. The Navy's development of aircraft is toward types that can perform this duty. In war time the Navy will have to and should do this work and the army will not have suitable planes for it, and, moreover, the Army will be occupied on its legitimate function, the land defense. It is extremely desirable as a matter of national policy that Congress fix responsibility by law for the defense of the United States in conformity with the approved plans of the War and Navy Departments as promulgated by the Joint Board."

THE K L FUEL SYSTEM

THE fuel system described herewith was designed to overcome the troublesome features which have been common to most of the complex systems now in use and to completely meet the exacting requirements of aeroplane work. A study of the design would indicate that these most desirable qualities have been well attained.

The designers have had many years' experience with the various systems and have stated the essential requirements of any fuel system to be:

1. A positive method of supplying fuel to the carburetor before the engine is started.
2. After the engine is started, an ample supply of fuel at the carburetor, under practically constant pressure, and under all possible conditions of engine loading and flight positions of the plane.
3. Fuel must be clean.
4. System must be arranged to take fuel from two or more tanks. Sufficient tank capacity for any reasonable length of flight is usually in two or more tanks in present type ships.
5. The system should be able to operate correctly, no matter what the relative location of the fuel tanks and the parts of the system.
6. The piping, connections and fittings must be an absolute minimum and the whole pipe system should be as near trouble and leak-proof as is possible.
7. It is also desirable to have as little piping and as few pipe joints *under pressure* as is possible.

The solution of this important problem has resulted in the admirable design described below, which is worthy of most careful consideration.

The whole system between the fuel tanks and the carburetor consists of but two major parts, viz: a hand pump and an engine-driven pump; with the connecting piping and strainer. A brief description of these two pumps will make the operation of the system apparent.

Engine-Driven Pump. A gear-type main fuel pump is arranged to be driven by the engine, Fig. 1, a practice now acknowledged to be the best, and thus the pump capacity is nearly in proportion to the fuel consumption. The capacity is, however, always in excess of the demand. All excess fuel delivered is lead from the discharge to the inlet side of the pump through a spring-loaded safety valve and passage contained in the pump body. The spring tension may be adjusted by an outside wheel and the discharge pressure regulated as desired. Such a return or relief system is usually made up of outside piping, but putting this in the pump body eliminates all outside piping and connections and so eliminates this source of leakage.

To provide a line for fuel delivered from the hand pump a passage is machined in the cover plate of the power pump and provided with a check valve preventing flow in the opposite direction. By this construction, another line of outside pipe common to some systems is eliminated.

Since reliability is the prime essential, all working parts are purposely made with a factor of safety greater than any part of the engine or plane.

This, together with the use of the best obtainable materials and the highest quality of workmanship are relied upon to make this unit the most reliable element of the entire power plant. The body is of "non-gran" bronze and the gears are or chrome nickel steel. The gears are cut with a special form of tooth so that a free-running long-life pump is the very desirable product.

The view in Fig. 1 shows the pump mounted in a bracket carrying a spiral gear drive arranged for direct attachment to a Liberty-12 Engine. The smaller connection opposite the pressure adjusting wheel is for a tube to the pressure gauge mounted upon the instrument board.

Ample stuffing boxes are provided around both the driving shaft and the spring-adjusting stem, but any leakage

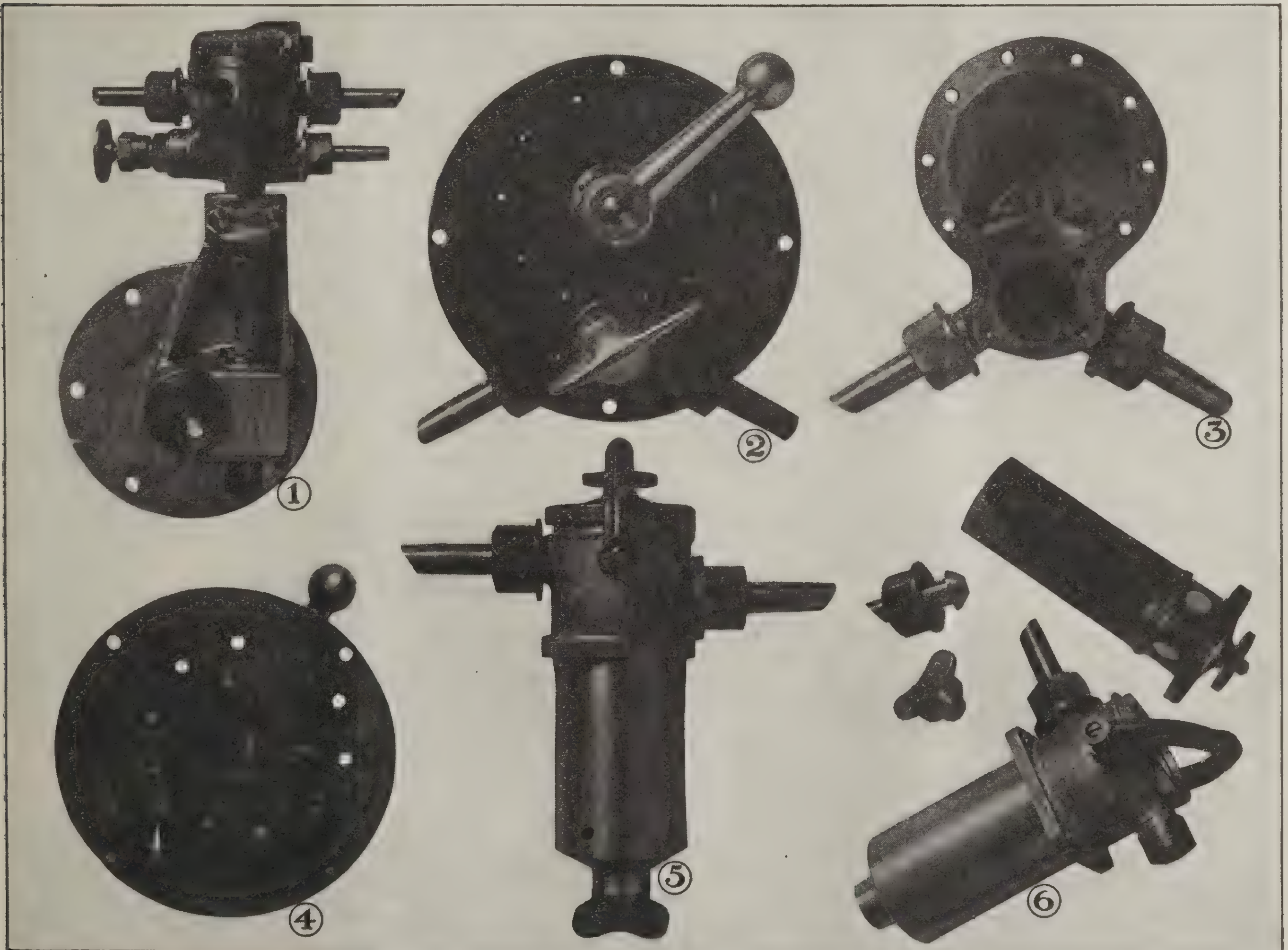


Fig. 1—Power Pump with drive and support for Liberty Engine. Fig. 2—Front of Hand Pump. Fig. 3—Exterior of hand pump showing inlet valves. Fig. 4—Cover and motor of hand pump. Fig. 5—Exterior of strainer. Fig. 6—Parts of strainer

along the driving shaft is drawn back to the suction side of the pump through a hole drilled from the clearance space around the shaft to the inlet passage and any leakage around the adjusting stem consists of air into the system rather than fuel out.

Hand Pump. This pump is of the so-called "wobble" or oscillating type, so successfully used abroad during the war and since. Figs. 2, 3, 4 and 5 show essential features of construction. Fuel enters through the two connections shown and passes through the combination two-way and shut-off valve, the extreme positions of which connect either tank and the mid position of which shuts off both lines entirely.

The plain suction valves in the lower valve plate, Fig. 4, and the discharge valves in the oscillating plate, Fig. 5, permit fuel to pass freely through the pump when it is not in action as a pump and thus makes it, at such time, a part of the fuel flow line.

On the back of the pump is a fuel return passage leading fuel from the discharge to the suction side through a spring loaded safety valve. This makes it impossible, by a too vigorous operation, to build up excessive pressure which might damage the pressure gauge or flood the carburetor in starting or in running.

Lock Unions. Every pipe connection in the entire system is a special extra-heavy ground-joint union locked in place, when made up, by a spring washer between the nut and shoulder on the male end. Provision for lock wires is also made and if further insurance against leakage is desired, all connections may be surrounded by rubber couplings. While provision has been made, in the past, for locking about all the fastenings of an aeroplane, it is believed that such important fastenings as pipe unions have not heretofore been locked.

Strainers. Believing that the strainers now in use were susceptible of improvement, a new design is supplied in order to prevent possible trouble from this simple but important element of the system. Fig. 6 is an exterior view and Fig. 7 shows the principal parts.

The fine-mesh straining surface is ample and easily removed for cleaning by releasing the nut and bale at the top. The plug at the bottom permits accuumalted water or sediment to be easily drained. Both operations are accomplished without disconnecting any piping or disturbing the mounting. Locked spring-washer unions

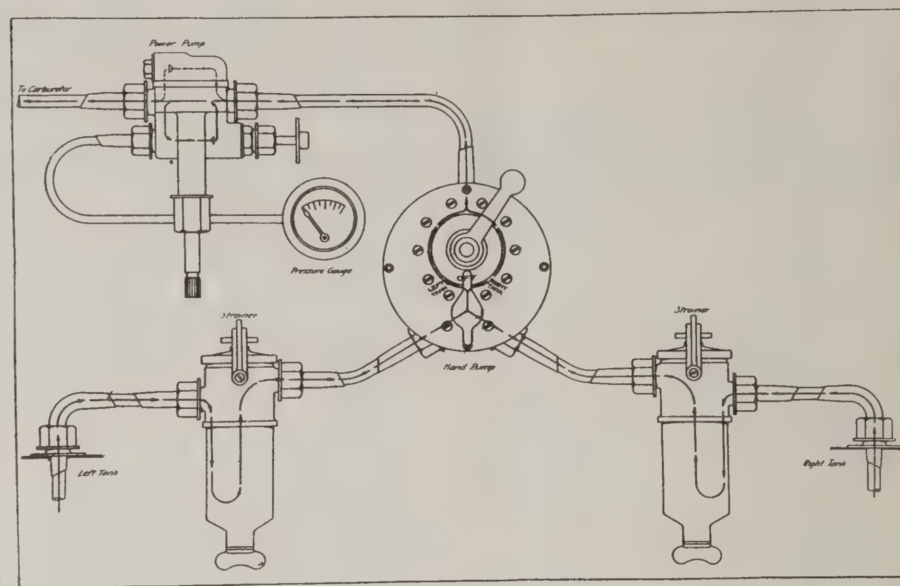


Diagram of the K. L. Fuel System

provide the pipe connections to this part as well as to all others.

The body is machined so that a strap support may be used, or the strainer may be supported on the square flange shown.

General Arrangement and Operation. The simplicity and mode of operation are illustrated in Fig. 8. It is seen that all parts of the system are in series, so to speak, and only a single line of pipe is used beyond the hand pump. The flow should be apparent from the drawing.

In starting, the hand pump is used to force fuel to the carburetor and incidentally prime the power pump. After the engine starts, the engine-driven gear pump furnishes fuel continuously, the pressure being automatically governed as previously described. The hand pump then becomes a part of the suction line. However, in case of failure of the power pump, the hand pump may be used continually to furnish fuel to the carburetor.

It should require but little thought to see that the system described fulfills, almost ideally, every requirement numerated at the start. Some very important features, which have been prolific sources of trouble in the past, are worth emphasizing. In the first place, the number of pipe connections and the amount of piping are reduced to an irreducible minimum. Secondly in the normal operation, there is no pressure on any part of the system, except the line running from the discharge of the power pump to the carburetor and to the pressure gauge and these short lines can be properly protected from leakage. The tendency on other parts of the system is for air leaks into rather than fuel leaks out. Third, the operation should be equally good and reliable, no matter what the relative elevations and locations of the main fuel tanks, parts of the system and the engine, thus permitting fuel tanks and other parts to be lorated where most convenient.

The power pump, the delivery line under pressure and the carburetor, by proper mounting, are integral parts of the engine and are thus free from liability to failure due to relative motion between the engine and plane as is common in most other systems.

While the power pump mounting and drive illustrated is for use on a Liberty Engine, suitable mounting and drive arrangements are being developed for use with all other standard aviation engines.

The entire system is being manufactured and sold by the K. L. Automotive Specialties Company, New York City.

EXPERIMENTAL NIGHT FLYING BY FLIGHT TEST SECTION, McCOOK FIELD

By LIEUT. MUIR S. FAIRCHILD

On the nights of February 24 and 25, and May 27, a number of test flights were made at McCook Field, Dayton, Ohio. The purpose of these flights was to determine the effectiveness of various devices for landing, and the efficiency of lighting arrangements in the cockpit, and to study other phases of night flying, such as the problem of exhausts and the reflection of light from propellers. Among the aeroplanes used were the JN-4H, the USXB-1 and the Glenn Martin Bomber.

Electric Landing Lights

In regard to the electric landing lights tested, it is believed that the type fitted with glass with vertical ribs was slightly more satisfactory than the type with horizontal ribs, owing to the fact that the former did not diffuse the light so much as the latter, and hence the blinding effect was not so great, particularly with respect to the propeller, which becomes a disk impossible to see through when light gets on it. In the May tests, a cherry red propeller was used on one of the aeroplanes with such satisfactory results as regards light reflection, that it would be well to finish all propellers on night-flying aeroplanes in this way.

However, neither of these lights could be considered very satisfactory, especially in view of their very large size and high power. It is thought that a more satisfactory result would be obtained with lights in which the beams were concentrated on a point on the ground some little distance in advance of the plane and which were fitted with some sort of side plates or blinders to keep the rays out of the propeller. The average pilot in landing a ship does not look at the ground immediately in front of the plane, but fixes his gaze on a spot some distance ahead, say from 50 to 75 feet. This is the spot which needs illumination and the illumination of the ground immediately in front of the plane and to the sides is neither necessary nor desirable.

It is believed that comparatively small but high powered lights throwing a searchlight beam could be used to much greater advantage, and that these lights might be streamlined into the wing tips in

the case of tractors or placed on the nose of pushers and bi-motored ships. When these could be made adjustable, vertically, from the pilot's seat, it would be an advantage to have them so, and where they could not easily be so made, they should be so adjusted as to throw the point of brightest illumination on each side at the approximate point a pilot would be looking at in the act of landing. The May tests showed that a 35 ampere bulb landing light gave very satisfactory results.

Wing Tip Flares

If magnesium flares are to be used, the greatest care is necessary in placing the control buttons of these flares in the cockpits of planes designed for service over the lines at night. It was noted particularly in the case of one aeroplane, equipped for night flying, that the flare buttons were so placed at the left of the cockpit that an incautious movement of the pilot's arm in the darkness might very readily set off a glare. At least one instance is known of a flare igniting over enemy territory which nearly resulted in the loss of the ship.

It would be extremely desirable to so perfect electric landing lights that they might be used to entirely replace flares. These flares are extremely dangerous devices and their functions could be performed much better and with far greater safety by electric landing lights. In using these flares on landing into a field with dry grass, the grass is inevitably ignited, resulting in the destruction of the plane by fire unless it can be quickly extinguished or the plane kept in motion in front of it. In the case of a forced landing at night, using the flares, which resulted in the slightest crash, the plane would almost certainly be burned and in the case of the crew being pinned in in any way, this would be a very grave danger. As the chances of a crash in forced landings at night are very great indeed, owing to the practical impossibility of seeing isolated obstacles by the light of flares, it is obvious that the magnesium flare is far from satisfactory and should be done away with as soon as possible.

Electric landing lights avoid all these difficulties and dangers, and are far more reliable than the flares. A flare cannot be tested without its destruction, and one never knows until it is needed whether or not it will light. If it is once lighted by accident over the lines there is nothing to do but let it burn out which is a very grave danger in the presence of anti-aircraft batteries or night pursuit. On the other hand, electric lights may be tested as often as desired and with the present standard of electric equipment may be considered to be as reliable as any device that could be constructed. Furthermore, they have the additional advantage that they are under the pilot's control at all times and may be turned off as well as on.

A further disadvantage of wing tip flares was developed. Fifty per cent of the number which passed the "continuity of circuit tests" started to burn and then went out because of deterioration of the active material. These tests showed that half of the flares which were passed for continuity of circuit, as explained in British Technical Orders, or as directed on the case of the flare, will not function.

For the foregoing reasons, it is recommended that steps be taken to perfect electric landing lights for standard equipment of all night flying ships and that magnesium flares be done away with as soon as this is accomplished.

Cockpit Lighting Arrangements

The difficulties of night flying over the lines are great enough under the best of conditions and everything possible should be done to make the crew's task as easy as possible. This applies especially to the arrangement of the cockpit and the instruments. This is a point which has not been sufficiently considered in the layout of some aeroplanes. With a bi-motored aeroplane, this becomes especially important. Certain instruments, for example oil pressure gages, are mounted on the engine nacelles. Other instruments, such as the gravity fuel tank overflow gages may be mounted outside the cockpit on the struts or nacelles. It is essential that the pilot be able to read these instruments without difficulty. For active service over the front, it is out of the question to use powerful flashlights to observe them. Making the dials of these instruments luminous by the use of luminous paint is not sufficient. Experiments should be carried out as to the practicability of inserting a small light under the glass of the instruments carried on the motor nacelles, and one behind the glass tubes of the overflow gages. These lights would be controlled by a push button in the cockpit and should be as dim as possible and still allow the instruments to be read. In commercial work, of course, no precautions have to be observed about showing lights, and the problem of lighting remote instruments is simplified.

Just as much care should be given to the arrangement of the instruments in the cockpit, and this applies with equal force to both military and commercial aeroplanes. Such an instrument as the air speed indicator, for instance, which is of vital importance to a pilot flying a heavily loaded plane on black nights, should be in plain view of the pilot and not behind the control column or wheel. Any instruments which depend for their visibility on luminous paint should be repainted as soon as they begin to become dim. Care should be taken in locating the compass so that it is not affected by the movement of any steel parts like the control column. The use of a Sperry compass of the Navy type would eliminate the errors due to the effect of the presence of iron or steel on a magnetic compass. On one of the aeroplanes tested, the shudder controls were located on the left side of the cockpit, the pilot's seat being on the right. As a result, they required great effort to operate and at the full extension of the pilot's arm sometimes could not be managed. It is essential in all aeroplanes with the side by side seating arrangement that these controls be so located that the pilot can operate them with a minimum of effort.

Luminous paint could be used to great advantage in many places where it is not used at present. For instance, it would be very desirable to have a dot of luminous paint on the altitude adjustment levers, and the open and closed positions of the throttle marked; also either a band of luminous paint or a noticeable raised band of tape that could be easily felt should be placed around the top neutral position at night.

Exhausts

It is very important that a night flying ship show as little exhaust flame as possible. In this respect the XB-1 was practically ideal. The manifolds and pipes remained black with wide throttle and practically no flame appeared at end of pipes. On another of the aeroplanes, the manifold and muffler pipes remained black but sheets of flame came out through the slit in the muffler for several inches making a band of light very difficult to look past at the ground and producing a blinding effect on the pilot and observer. This type of muffler would be unsatisfactory for a night flying ship. The manifolds of the aeroplanes equipped with Liberty motors got nearly white hot almost to the ends of the pipes and flame appeared two to three feet out of the ends of the pipes. This not only produced a blinding effect in looking straight down and to the rear, but would be very bad indeed in the presence of night pursuit, as it provided an illumination that could be seen for some distance. It is recommended that experiments be carried out with a view to designing manifolds and pipes for the Martin that will give the same effect as those of the XB-1.

Parachute Flares

The tests conducted with parachute flares were very unsatisfactory as only a few opened and lighted. This, however, was due to the poor quality of the particular flares used, they being old stock in storage since 1918. The few which worked showed conclusively that they would be of the greatest aid in picking a field in case of forced landing, and there is no question but that they must be included in standard equipment for night flying ships. It is thought that some very profitable experiments might be made with a view to producing a more efficient, reliable and lighter weight parachute flare than the present standard which is the French Michelin flare.

Beacon Lights

A small beacon light of French manufacture was observed from various angles, altitudes and distances up to ten miles. The results were so satisfactory, in spite of mist and fog, that it is believed a larger beacon light of this general type should be constructed. The cost of this large light will be very much less than that of any commercial type of acetylene operated beacon. The Navy type of "blinker" light, as arranged for secret signalling was observed during the same flight, but it was not sufficiently powerful to be visible at the longer distances.

Goggles

An accident to one of the ships during the May tests strongly brought out the dangers of using amber colored glasses for night work. The danger of using colored goggles of any kind in night flying cannot be overestimated.

THE VARIATION OF AEROFOIL LIFT AND DRAG COEFFICIENTS WITH CHANGES IN SIZE AND SPEED

By WALTER S. DIEHL

Bureau of Construction and Repair, U. S. N.

THIS report, prepared by Walter S. Diehl at the request of the National Advisory Committee for Aeronautics, contains the results of an investigation of existing scale correction data and the derivation of an original method for making these corrections rapidly and accurately. The following summary outlines briefly the subject as treated in the report.

Summary

1. General statement of the principle of dynamic similarity as applied to the problem of determining the variation of the lift and drag of an aerofoil with (variations in) the size and speed.

2. Interchangeability of v and l. Notes on limitations as found by experiment.

3. Review of existing scale correction data. Criticism and comments on the method employed by the N. P. L.

4. Determination of the variation of D_c with scale. It is shown that the minimum drag varies as $(vl)^{1.84}$ in a number of tests and must therefore be due almost entirely to a viscosity effect. Assuming that any increase in the drag coefficient, over the minimum, is due to inertia effects, the relation between the drag coefficients at any angle for the values of vl is

$$D_{c_2} = D_{c_1} - D_{c_0} \left[1 - \left(\frac{v_2 l_2}{v_1 l_1}\right)^{-0.16}\right]$$

where

D_{c_2} = drag coefficient at $v_2 l_2$

D_{c_1} = drag coefficient at $v_1 l_1$

and

D_{c_0} = minimum drag coefficient at $v_1 l_1$

The formula is checked by test results.

5. Variation of L_c with scale. It is found that at any given angle of attack the lift coefficients for the two values of vl bear the relation

$$L_{c_2} = L_{c_1} + \triangle L_c$$

$$= L_{c_1} + .057 \log_{10}\left(\frac{v_2 l_2}{v_1 l_1}\right)$$

where

L_{c_2} = lift coefficient at $v_2 l_2$

L_{c_1} = lift coefficient at $v_1 l_1$

The value of the constant 0.057 was determined from existing experimental data.

6. Applications and limitations. Method of applying formula. Discussion of limitations.

7. Conclusions.—It is recommended that the formulæ be checked by accurate tests made for this purpose and extending over a large range of vl.

Introduction

A general expression for the resistance or reaction due to relative motion between a fluid and an immersed body may be written by application of the principle of dimensional homogeneity. If the motion be uniform and the fluid incompressible it is found that the reaction is given by

$$R = \rho v^2 l^2 f\left(\frac{vl}{\nu}\right) \qquad (1)$$

where

ρ = density of the fluid,

v = relative velocity,

l = some linear dimension of the body,

μ = viscosity of the fluid,

and

$\nu = \frac{\rho}{\mu}$, the kinematic viscosity.

The derivation of the expression is due to Lord Rayleigh[1] and may be found in any treatise on aerodynamics. (See Bairstow, "Applied Aerodynamics," Ch. VIII.)

In most aeronautical engineering computations it is customary to neglect the variations of ν and to consider only variations of v and l. This is justified since model tests and flying are usually carried out under conditions which render ν substantially constant. The product of the velocity, v, in feet per second, and the chord, l, of an aerofoil in feet is then referred to as the "vl" or "scale" of the test or flight.

This investigation is concerned with the determination of the functions of vl which express the variations of lift and drag coefficients of an aerofoil, with particular reference to the application of model tests to full-size aeroplane performance.

Before discussing the previous work in this field it seems desirable to call attention to certain phenomena connected with the limitations of the interchangeability of v and l.

Interchangeability of V and L

It should be noted that the condition of dynamic similarity, which may be expressed $v_1 l_1 = v_2 l_2$, presupposes geometrical similarity. This is equivalent to saying that geometrically similar aerofoils will give identical characteristic curves when tested at speeds inversely proportional to their chords.

This interchangeability of v and l and the dependence of aerofoil coefficients upon their product has been accepted for many years as being necessary from a physical standpoint. The validity of the assumption has sometimes been challenged but never disproved. On the other hand the results of various tests such as those made at N. P. L. on two geometrically similar aerofoils (Br. A. C. A., R. and M. No. 148) and at Göttingen on several series of geometrically similar aerofoils. (Kumbruch—Zeitschrift für Flugtechnik und Motorluftschiffahrt, May 31, 1919) are to be taken as positive proof.

However, it is well known to everyone who has had occasion to study the results of many aerofoil tests that there are certain limits within which it is necessary to keep both v and l, if the data are to be reliable. For instance, if the velocity of the wind during a test be less than 30 f. p. s., or if the chord of the model be less than 3 inches, the flow is determined not only by the aerofoil section but also by the method of supporting the model and the quality of the air flow, or turbulence present in air stream. The upper limit to velocity depends chiefly upon compressibility and may arbitrarily be set at 200 f.p.s., at which speed the effect is of the order of 1 per cent.

It may therefore be said with some confidence that the laws connected with dynamic similarity apply to aerofoils subject to the limitations just mentioned.

N. P. L. Scale Corrections

By far the greatest amount of testing for scale effect has been done at the National Physical Laboratory. In a series of three reports of the British Advisory Committee for Aeronautics (R. and M. Nos. 72, 110, and 148) monoplane aerofoil characteristics for the R. A. F.—6 section and modifications are given for values of vl from 2.5 to 40. In another report (Br. A. C. A., R. and M. No. 196) Biplane R. A. F.—6 characteristics are given for values of vl from 5 to 16.5. In addition to these systematic tests a large number of aerofoils have been tested at two or more speeds.

Although the data on scale effect thus accumulated are comparatively extensive, it appears that but little attention has been given to the actual determination of the laws involved. It has been customary since R. and M. No. 72 was published to plot scale tests with the aerofoil characteristics as ordinates and vl (or log vl) as abscissae, drawing a line for each angle of attack through the values of L_c, D_c, or L/D at the corresponding values of vl. This method will give satisfactory results only so long as the curves are used on similar aerofoils. On account of the great gap between the highest vl obtainable in the present wind tunnel tests and the vl of the average machine in flight, it leads to a conclusion which is in error. Figures 1, 2 and 3 are taken from a report by Mr. E. F. Relf, "An Empirical Method for the Prediction of Wing Characteristics from Model Tests, Compiled from Existing Experimental Data" (Br. A. C. A., R. and M. No. 450, June, 1918), and presumably represent the latest N. P. L. scale correction data. In the summary to this report the following conclusion is given: "With regard to the $\frac{vl}{v}$ correction it appears -- that the model results can be directly applied without any great error, if the wing vl of the test is greater than 25 in ft.²/sec." It had been stated in a previous report (Br. A. C. A., R. and M. No. 72, Sec. VI) that there was no scale effect above a vl of 40. Referring to figures 1, 2, and 3 it appears on first sight that there is ample basis for this conclusion. However, if the curves from figures 1 and 3 be replotted on a logarithmic scale as in figures 4 and 5, it immediately becomes evident that the effect of scale is operating according to the same law at $vl = 40$ as at lower values of vl. It is in order to mention that this effect has been noted in a more recent report (Br. A. C. A., R. and M. No. 656, November, 1919), which states that "The drag coefficient of the model is still changing with speed at the highest speed of the experiments. The same is true of the lift coefficient to a very small extent."

The greatest difficulty experienced in applying the correction curves of figures 1, 2, and 3 occurs with high lift aerofoils, such as the RAF — 19. In general it is found that the method is rather unsatisfactory on account of its limitations.

Variation of D_c with Scale

An inspection of figure 5 will reveal two outstanding features. First, that the minimum drag coefficient, or rather the drag coefficient at an angle attack corresponding very nearly to the minimum drag, decreases as vl is increased in such a manner that all of the values lie on a straight line which has the slope — 0.14. This indicates that the minimum drag

[1] Br. A. C. A., R. and M. No. 15.

varies as $(vl)^{1.86}$ instead of $(vl)^2$, and is consequently due almost entirely to skin friction, or more properly, perhaps, to a "viscosity effect." Second, that the higher values of D_c do not follow the same law, since the successive values of D_c, as vl is increased, lie on lines which are concave upward. Before drawing any conclusions from these observations it is desirable to examine a number of tests to see if the phenomena are universal.

Upon plotting to a logarithmic scale, as in figure 5, the drag coefficients from available tests, there is obtained in every case a group of lines very similar to those in figure 5. It is to be noted that the slope of the line representing minimum drag is slightly greater in the groups obtained from test data. This slope is quite unform and of the average value — 0.16. A specimen group is given in figure 6 to illustrate the general nature of all.

It can therefore be shown that the minimum drag of an aerofoil is almost entirely due to a viscosity effect, which is to say that

$$\text{minimum drag} \propto (vl)^{1.84}$$

$$\text{or minimum } D_c \propto (vl)^{-0.16} \qquad \ldots\ldots (2)$$

Now so long as the flow over the aerofoil is nonturbulent, the magnitude of the viscosity effect can not change by any great amount. But it has been shown by Betz (Technische Berichte 1—4, for translation see N. A. C. A., T. N. No. 41) that

$$D_{ci} = \frac{2L_c^2}{\pi} \frac{S}{b^2} \qquad \ldots\ldots (3)$$

where S = the area of the aerofoil,
b = the span,

and D_{ci} = the coefficient of the "induced drag." That is D_{ci} is a measure of the inertia reaction, in the direction of flight, experienced by aerofoil in imparting to the encountered air the downward deflection which produces the lift represented by L_c. Since D_{ci} is an inertia effect it must vary as $(vl)^2$. Consequently the total drag, which is assumed to vary as $(vl)^2$, has two components, the one varying as $(vl)^{1.84}$, the other as $(vl)^2$. The scale correction to the coefficient of total drag, D_c, must therefore be concerned only with that part of the drag which varies as $(vl)^{1.84}$, and since this part is due to an effect which renders it practically constant over the range of angles corresponding to steady flow it follows that the effect of a change in vl is to add to or subtract from each value of D_c a constant amount. This may be expressed in symbols as:

$$\text{at } v_1l_1,\ D_{c1} = D_{ci} + D_{cv} \qquad \ldots\ldots (4)$$

$$\text{at } v_2l_2,\ D_{c2} = D_{ci} + D_{cv} \pm \Delta D_{cv} \qquad \ldots (5)$$

$$\text{or} \quad D_{c2} - D_{c1} = \pm \Delta D_{cv} \qquad \ldots\ldots (6)$$

where D_{ci} = that part of D_c due to inertia effects and varying as $(vl)^2$.

D_{cv} = that part of D_c due to viscosity effects and varying as $(vl)^{1.84}$.

ΔD_{cv} = the correction to D_{cv} necessary to allow for the fact that D_{cv} varies as $(vl)^{1.84}$ instead of $(vl)^2$.

In order to obtain a definite check upon the above conclusions it is necessary to compare at each angle the drag coefficients obtained from tests on an aerofoil at two values of vl. There should be a difference between the two coefficients at each angle (within the limits previously stated), of ΔD_{cv}, which is given by

$$\Delta D_{cv} = D_{cv} - D_{cv}\left[\frac{(v_2l_2)^{1.84}}{(v_1l_1)^2}\right]$$

$$= D_{cv}\left[1 - \left(\frac{v_2l_2}{v_1l_1}\right)^{-0.16}\right] \qquad \ldots\ldots (7)$$

Since D_{cv} is substantially equal to the minimum value of D_c, which may be denoted by D_{co}, the above expression may be written

$$\Delta D_c = D_{co}\left[1 - \left(\frac{v_2l_2}{v_1l_1}\right)^{-0.16}\right] \qquad \ldots\ldots (8)$$

A number of tests have been compared on this basis in the manner illustrated by Table I, the results being tabulated in Table II. It is found that the values of $\triangle D_c$ are not only very nearly constant but that they check very closely with values given by equation 8. It is particularly to be noted that the aerofoil sections listed in Table II include every type from the double cambered RAF—20 to the deeply cambered RAF — 19. The RAF — 20 has a very low D_{co} and the RAF—19 a very high D_{co}, yet the calculated and observed values of $\triangle D_c$ agree very well in each case. This agreement is to be interpreted as a strong confirmation of the formula, which appears to be a very satisfactory approximation applying equally well to all aerofoils.

For convenience in making corrections and comparisons the expression

$$\left[1 - \left(\frac{v_2l_2}{v_1l_1}\right)^{-0.16}\right]$$

has been plotted in Fig. 8.

VARIATION OF L_c WITH SCALE

There is very little to be learned from an inspection of figure 4 in regard to the variation of L_c with vl. These data when plotted on logarithmic scales agree very well with figure 4 but are disappointing on account of the low ranges of vl. A typical plot is given in figure 7 to illustrate the general appearance of test data.

If a careful study be made of the various tests it will be observed that the effect of increasing vl is to increase by a small amount each lift coefficient within the range of angles corresponding to nonturbulent flow. It will also be observed that the average increase in L_c is the same absolute quantity when vl is increased, for example, from 5 to 10 as from 10 to 20. That is to say, the average value of $\triangle L_c$ is proportional to the ratio $\left(\frac{v_2l_2}{v_1l_1}\right)$ and increases arithmetically as vl increases geometrically. $\triangle L_c$ should therefore be given by an expression of the form

$$\triangle L_c = K. \log\left(\frac{v_2l_2}{v_1l_1}\right) \qquad (9)$$

where K is a constant to be determined from test data.

Table III contains data from a series of tests on two RAF—6a aerofoils with the corresponding values of $\triangle L_c$. The same method was employed on other tests to obtain the values of $\triangle L_c$ given in Table IV. The results are surprisingly consistent when consideration is given to the

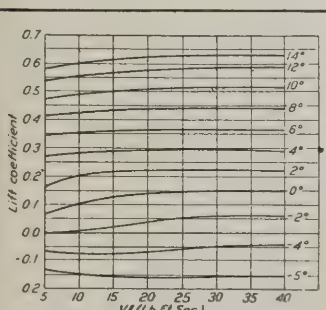


FIG. 1.—Correction to lift coefficient for scale effect. Reproduction of figure 19, B. A. C. A. R. & M. No. 450.

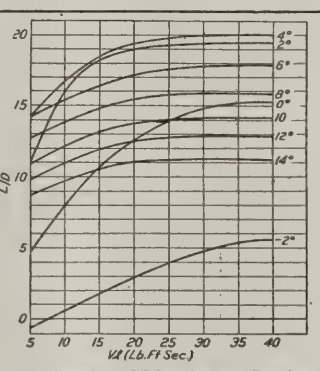


FIG. 2.—Corrections to L/D for scale effects. Reproduction of figure 20, B. A. C. A. R. & M. No. 450.

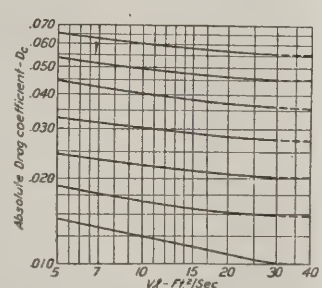


FIG. 5.—Variation of drag coefficient with Vl. Re-plot of figure 21, B. A. C. A. R. & M. No. 450. (See Fig. 3.)

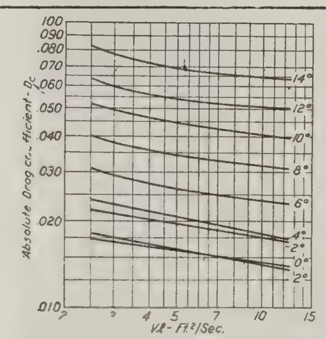


FIG. 6.—Variation of drag coefficient with Vl. Data from B. A. C. A. R. & M. No. 110. R. A. F. 6 Aerofoil.

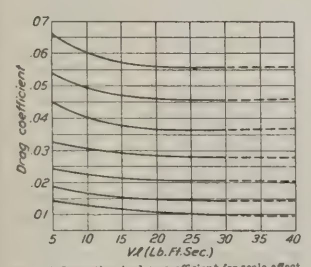


FIG. 3.—Correction to drag coefficient for scale effect. Reproduction of figure 21, B. A. C. A. R. & M. No. 450.

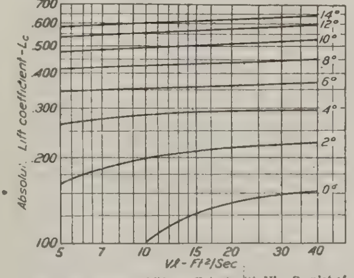


FIG. 4.—Variation of lift coefficient with Vl. Re-plot of figure 19, B. A. C. A. R. & M. No. 450. (See Fig. 1.)

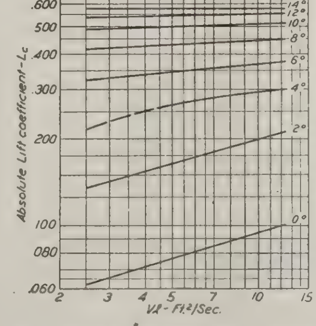


FIG. 7.—Variation of lift coefficient with Vl. Data from B. A. C. A. R. & M. No. 110. R. A. F. 6 Aerofoil.

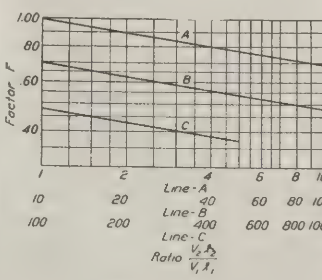


FIG. 8.—Evaluation of $F = \left[1 - \left(\frac{V_2l_2}{V_1l_1}\right)^{-0.16}\right]$

fact that $\triangle L_c$ is obtained as the differences between two nearly equal values of L_c, each subject under the best of conditions to an error of 2 per cent or more. The average of a number of readings should eliminate such errors, however.

Table IV contains all data used in the determination of K, which is found to be

$$K = .057$$

The value of the lift coefficient L_{c2} at a given angle of attack and v_2l_2 is therefore given by

$$L_{c2} = L_{c1} + .057 \ \log_{10}\left(\frac{v_2l_2}{v_1l_1}\right) \qquad (10)$$

where L_{c1} is the lift coefficient at the same angle and v_1l_1.

It is to be noted that the value of K seems independent, not only of the type of aerofoil section but also of the arrangement, i. e., monoplane or biplane.

The method has been applied to tests on a complete model aeroplane (Br. A. C. A., R. and M. No. 656) with satisfactory results. It is unfortunate that free flight test data available for comparison are too erratic to be used, except at large angles where it checks very well with that calculated by 10.

Applications and Limitations

In applying these corrections it is necessary to employ data obtained at a vl sufficiently high to eliminate all uncertainty in regard to steadiness of flow. There are so many factors which influence steadiness of flow that it is difficult to specify a lower limit to vl although in general it may be said that the results obtained from tests on a model of 3″ chord at 40 f. p. s. are reliable, but neither velocity nor chord should ever be less than these figures.

The application of the corrections should also be limited to the range of angles corresponding to steady flow roughly from zero lift to maximum lift.

In regard to limitations, there have been tests on certain double cambered aerofoils in which the lift coefficient was found to decrease as vl was increased. Data are lacking to indicate the cause of this reversal, but since other double cambered aerofoils behave in the usual manner it is possible that the phenomena may be due to some special condition or type of flow.

In a few cases, the lift curves for tests at two or more values of vl on the same aerofoil coincide over a range of several degrees in the angle of attack. Special tests are required to indicate whether or not an individual correction of the same general form as equation 10 should be applied at each angle of attack in such cases.

Conclusions

It has been shown that the value of the drag coefficient varies with vl according to the expression.

$$D_{c2} = D_{c1} - D_{c0}\ [1 - \left(\frac{v_2l_2}{v_1l_1}\right)^{-0.16}] \qquad (11)$$

where D_{c1} is the drag coefficient at a given angle of attack and v_1l_1.

D_{c0} is the minimum drag coefficient at v_1l_1 and D_{c2} is the drag coefficient at the same angle of attack as D_{c1} but at v_2l_2.

It has also been shown that the lift coefficient at v_2l_2 is given by

$$L_{c2} = L_{c1} + 0.57 \ \log_{10}\left(\frac{v_2l_2}{v_1l_1}\right) \qquad (10)$$

where L_{c1} is the lift coefficient at v_1l_1 for the particular angle of attack under consideration.

The most obvious criticism of these formulæ is that they are based on low values of vl. The only tests at high values of vl, available for inclusion in this study were those made at Göttingen and reported by Kumbruch in the Zietschrift für Flugtechnik und Motorluftschiffahrt, of May 31, 1919. Unfortunately the forces involved in the Göttingen tests were so large that the models deflected until the angles of attack were uncertain. The models were also of aspect ratio 2.5 and end plates were used to eliminate the tip losses. Although corrections were made for aspect ratio and the interference between the model and the walls of the tunnel it is felt that the effect of scale is not given by the final results.

It is recommended that the formulæ 10 and 11 be checked by tests extending over a large range of vl. Such tests should be made with more than usual care in measuring the angle of attack and wind velocity. The results so obtained should be checked with reliable free flight performance data.

TABLE I—*Determination of D_c, monoplane R A F-6.* (Data from Br. A. C. A., R. and M. No. 110.)

α	D_c $v_1l_1=7.5$.	D_c $v_2l_2=12.5$.	$-\Delta D_c$	
−6	0.0377	0.0370	0.0007	
−4	.0255	.0250	.0005	$\left(\frac{v_2l_2}{v_1l_1}\right)^{-0.16} = (1.67)^{-0.16} = 0.923$
−2	.0183	.0170	.0013	
0	.0152	.0138	.0014	
2	.0152	.0135	.0017	
4	.0190	.0173	.0017	Minimum $D_{c0} = .0152$
6	.0244	.0235	.0009	
8	.0331	.0313	.0018	$\Delta D_c = D_{c1} - 0.923\ D_c$
10	.0418	.0398	.0020	
12	.0514	.0510	.0004	$= 0.077 \times .0152$
Average			.00124	$= .00117.$

TABLE II—*Comparison of D_c calculated and observed.* (See Table I.)

v_1l_1	v_2l_2	$\frac{v_2l_2}{v_1l_1}$	Min. D_c	ΔD_c calculated.	Average ΔD_c observed.	Section.	Arrangement.	Reference.
7.5	12.5	1.67	0.0152	0.0012	0.0012	RAF-6c	Monoplane	R. and M. 110
5	12.5	2.5	.0157	.0020	.0022	Do.	Do.	Do.
5	10	2.0	.0158	.0016	.0012	RAF-6	Do.	Do.
5	12.5	2.5	.0158	.0020	.0023	Do.	Do.	Do.
5	20	4.0	.0142	.0027	.0031	RAF-6A	Do.	R. and M. 148
15	30	2.0	.0119	.0012	.0013	Do.	Do.	Do.
5	16.5	3.3	.0143	.0023	.0020	RAF-6	Biplane	R. and M. 196
7	12.5	1.67	.0142	.0010	.0013	Do.	Do.	Do.
20	40	2.0	.0117	.0012	.0012	Propeller	Monoplane	R. and M. 362
30	40	1.33	.0101	.0005	.0006	Do.	Do.	Do.
5	14.6	2.92	.0410	.0061	.0058	RAF-19	Do.	R. and M. 415
5	10	2.0	.0410	.0041	.0047	Do.	Do.	Do.
5	10	2.0	.0083	.0008	.0007	RAF-20	Do.	Do.

TABLE III—*Test data from R. and M. No.* 148, *showing method of obtaining ΔL_c.*

α	$vl=5$ L_c	$vl=10$ L_c	$vl=15$ L_c	$vl=20$ L_c	$vl=30$ L_c	vl 30−vl 5 ΔL_c	vl 30−vl 10 ΔL_c	vl 30−vl 15 ΔL_c	vl 30−vl 20 ΔL_c
−4	−0.066	−0.064	−0.074	−0.066	−0.048	0.018	0.016	0.026	0.018
−2	− .061	+ .010	+ .022	+ .037	+ .060	.061	.050	.038	.023
0	+ .068	.102	.127	.136	.145	.077	.043	.018	.009
2	.162	.207	.215	.214	.218	.056	.011	.003	.004
4	.269	.284	.283	.286	.293	.024	.009	.010	.007
6	.346	.355	.357	.358	.365	.019	.010	.008	.007
8	.413	.424	.431	.434	.441	.028	.017	.010	.007
10	.472	.489	.500	.505	.513	.041	.024	.013	.008
12	.537	.551	.563	.572	.585	.048	.034	.022	.013
14	.577	.584	.615	.616	.627	.050	.043	.012	.011
Average ΔL_c						.0422	.0257	.0160	.0107

TABLE IV—*Determination of K in the equation.*

$$[L_{c2} = L_{c1} + K.\log_{10}\left(\frac{v_2l_2}{v_1l_1}\right).]$$

No.	v_1l_1	v_2l_2	Average ΔL_c	$\frac{(v_2l_2)}{(v_1l_1)}$	$\log_{10}\frac{(v_2l_2)}{(v_1l_1)}$	K.	Section.	Reference.
1	2.5	5	0.0174	2	0.3010	0.0578	Monoplane RAF 6	R. and M. No. 110
	5	10	.0170	2	.3010	.0564		
	2.5	12.5	.0394	5	.6990	.0564		
2	5	30	.0422	6	.7782	.0542	Monoplane RAF 6c	R. and M. No. 148
	10	30	.0257	3	.4771	.0538		
	15	30	.0160	2	.3010	.0532		
	20	30	.0107	1.5	.1761	.0608		
3	5	10	.0173	2	.3010	.0572	Biplane RAF-6	R. and M. No. 196
	5	16.5	.0329	3.3	.5185	.0635		
	7.5	12.5	.0138	1.67	.2219	.0622		
	7.5	16.5	.0217	2.2	.3424	.0632		
4	40	35	−.0034	.875	−.0581	.0585	Propeller aerofoil: $x/c=0.5$ $\frac{h}{c}=.075$	R. and M. No. 362
	40	30	−.0063	.750	−.1239	.0510		
	40	25	−.0116	.625	−.2041	.0568		
	40	20	−.0176	.50	−.3010	.0585		
5	5	10	.0176	2	.3010	.0585	Monoplane RAF-19	R. and M. No. 415
	5	14.6	.0238	2.92	.4654	.0511		
6	5	14.6	.0267	2.92	.4654	.0574	Monoplane RAF-20	R. and M. No. 415
Average						.0570		

OPERATING TESTS OF MAGNETICALLY OPERATED STARTING SWITCHES

THE object of these tests was to determine whether or not the magnetically operated starting switches supplied by the Bijur Motor Appliance Co., Hart Manufacturing Co., and the United States Light & Heat Corporation were satisfactory for aeroplane use.

Time and Place

Samples of each of these three types of switches were tested by the Electrical Branch of the Equipment Section at McCook Field, Dayton, Ohio, October 27, 1920.

Description of Switches

The switch manufactured by the Bijur Motor Appliance Co. is an adaptation of their standard manually operated switch.

Switches manufactured by the Hart Manufacturing Co. and the United States Light & Heat Corporation were especially designed for use as remote control switches. Photographs of these types of switches are embodied in this report.

Method of Test

The source of power for these tests was a standard 600-watt propeller-driven generator, belt connected to a Liberty engine. The overload cut-out on this generator was held shut and the voltage regulator field resistance was shorted in order to obtain approximately 300 per cent overload momentarily. The load used was a standard Bijur propeller end starter as arranged for "Liberty 12."

The operating test consisted of closing the switch which was in series between the generator and the starting motor for time intervals sufficient to allow the starting current to reach a maximum value of approximately 150 amperes. When the maximum current value was reached the switch was opened under load. This process was repeated in rapid succession 1,000 times for each switch. The switch was then disassembled and examined for signs of wear, burning, or pitting of contacts. At the conclusion of the operating tests the solenoid coils of these switches were placed on a normal voltage heat run, which was continued until the maximum temperature shown by resistance measurements was reached. At the conclusion of the heat run the standard high potential test of 500 volts alternating current was applied in the usual manner.

Results of Tests

	Pounds.
Weight of Bijur switch	2.90
Weight of U. S. L. switch	2.40
Weight of Hart Switch	2.70

(Concluded on page 522)

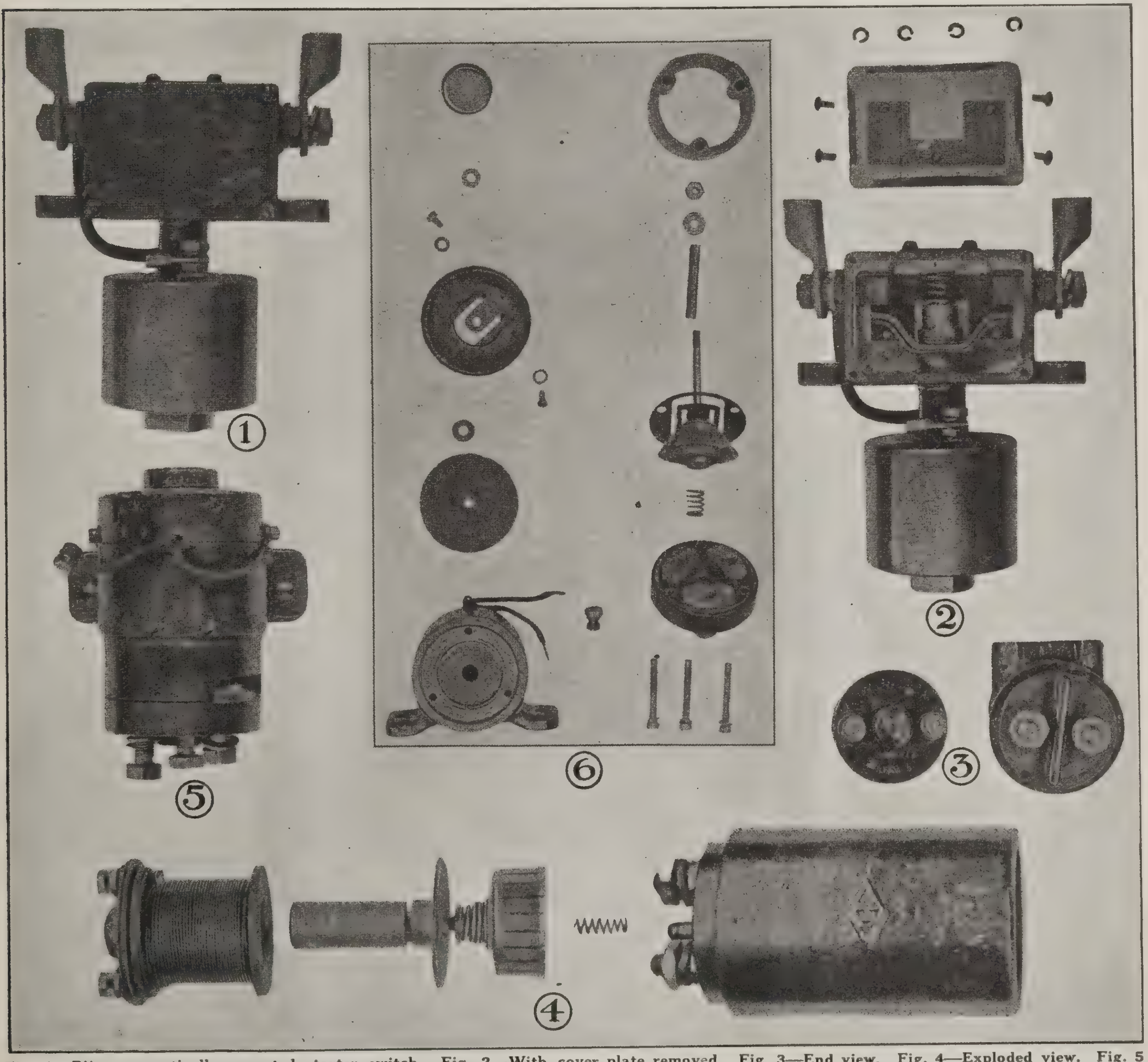


Fig. 1—Bijur magnetically operated starter switch. Fig. 2—With cover plate removed. Fig. 3—End view. Fig. 4—Exploded view. Fig. 5—U. S. L. magnetically operated starting switch. Fig. 6—Parts of U. S. L. magnetically operated starting switch

FOREIGN TECHNICAL DIGEST

The L.F.G.-V3a Flying Boat

The L.F.G.-V3a flying boat is a rigid truss monoplane passenger machine, produced during 1920 by the Strelsund Works of the Luft - Fehrseng - Gesellschaft (L.F.G.) at Berlin. The power-plant consists of a 150 h.p. Benz 6-cylinder engine and recently a 185 h.p. B.M.W. 6-cylinder engine (Bavarian Motor Works). The hull is of very great span, and no side-floats (auxiliary-floats) are used. The hull, the enclosed cabin, the ailerons and the tail (tail-plane, elevators, fin, rudder) are of duralumin metal construction. The ailerons, the elevators and the rudder are of the balanced type. The engine drive, a pusher-airscrew. Three or four passengers can be carried. The main dimensions, weights and performances are the following:—

Engine . . 150 h.p. Benz or 185 h.p. B.M.W.
Span .... 14.45 m.
Length .... 3.50 m.
Height .... 2.35 m.
Wing area .... 30 sq. m.
Airscrew diameter .... 2.70 m.
Weight empty .... 9.70 kg.
Weight loaded .... 14.70 kg.
Total load .... 500 kg.
Wing loading .... 49 kg. p.sq.m.
Power loading .... 10.9 kg. p.h.p.
Speed .... 150 km.p.h.
Fuel capacity .... 218 ltr.
Range .... 600-650 km.

(*Aeronautics*, July 7, 1921)

New Italian Airship

Since the sale of the Italian airship *Roma* to the U. S. of America, Italy has ordered the construction of a new big semi-rigid by the Department of Aeronautical Construction.

The main features of this new airship are as follows:

Volume .... 42,000 c.m.
Length .... 160 m.
Width .... 25 m.
Height .... 27 m.
Engines .... 12 Spa, 200 h.p. each—total h.p., 2,400.
Maximum speed .... 110 km. per hour
Normal speed .... 85 km. per hour
Range .... 5,600 km. normal speed.

In addition a small semi-rigid for the training of pilots will be built to the following specification:—

Volume .... 1,100 cm.
Length .... 40 m.
Width .... 8.50 m.
Height .... 13 m.
Engines .... 2 engines, 35 h.p. each
Maximum speed .... 75 km. per hour
Range .... 500 km. with 4 passengers on board.

The price of construction will not exceed that of an automobile *de luxe*.

(*Aeronautics June* 30, 1921)

A Novel Carburetor

The Hannen carburetor, recently placed on the market in Germany, possesses several interesting features. The proper mixture strength to suit atmospheric conditions can be adjusted by means of two micrometer screws. The main jet is a single jet. The slow-running jet communicates by a channel with the suction pipe above the throttle and the amount of mixture passing through this channel is regulated by a tapered drum with holes in it. The air necessary for this jet enters from the suction chamber by a second channel below the throttle. This same channel helps to create a partial vacuum in the slow-running jet at high speeds and thus diminishes the discharge from the main jet.—(Wa. Ostwald, *Auto-Technik*, Feb. 12, 1921. 1½ cols., 1 fig.)

Measuring Temperatures in Internal-Combustion Engines

Mr. P. Ferretti, in an article in the January issue of the *Rivista Marittima*, exhaustively examines this question. After describing the hydrogen gas thermometer, the resistance thermometer and the Callendar, Burstall, Petersen and Wolff instruments and the various results obtained by these experimenters, he proceeds to deal in detail with the thermo-electric thermometer and the experience of Bams, Stronhal and others with this apparatus; he states that measuring the temperature directly and satisfactorily was solved for laboratory purposes and has now been equally solved for industrial purposes in the apparatus described by Professor Belluzo and Commander Cardona.

Reduced to its most simple expression, it is composed of an exploring element (a thermo-electric pyrometer) in contact with the gas inside the engine cylinder and a galvanometer which at any moment gives the measurement of the temperature assumed by the sensitive wire, or the mean ordinate of the temperature diagram, *i.e.*, the mean temperature during the cycle. If care be taken to check the galvanometer during the tests of the engine on the testing bed at various loads and to graduate the quadrant in millivolts or in degrees equivalent to I.H.P., or, better still, shaft H.P., the galvanometer index will give at any moment the I.H.P., or, better, the E.H.P., and thus the apparatus will serve as an instantaneous power indicator.

When it is a question of a multiple cylinder engine it is quite sufficient to arrange an exploring element on each cylinder connecting all these up successively to the same galvanometer by means of a revolving commutator worked by the engine itself. The value of this lies in the fact that an idea of what is taking place in the several cylinders can be obtained immediately without requiring any operation on the part of the man in charge of the engine.

Frequently with internal-combustion engines, and with the Diesel type in particular, a cylinder is over-loaded owing to combustion in the other cylinders not having developed the necessary power due to imperfect pulverization of the fuel, etc. This possibility is carefully watched on the testing bench, but once the engine is in place rule of thumb methods hold the field, which should not be, and engineers should have some method whereby the combustion process in the cylinder can be watched. —(*Rivista Marittima*, Jan., 1921. 62 pp., 37 figs.)

(*Concluded from page* 521)

DATA FOR BIJUR SWITCH

Switch stuck closed six times during the operation test and was badly pitted when disassembled.

Heat run data

Time.	Volts.	Amperes.
12.50	12.00	3.45
.55	12.00	2.85
1.00	12.00	2.65
.05	12.00	2.55
.10	12.00	2.50
.15	12.00	2.50
.20	12.00	2.50

High potential test broke down at 500 volts.

Closing amperes, 0.6.

Closing volts, 2.0.

DATA FOR U. S. L. SWITCH

Gave no trouble and showed no signs of wear.

Heat run data

Time.	Volts.	Amperes.
1.30	12.00	3.7
1.35	12.00	3.4
1.40	12.00	3.35
1.45	12.00	3.23
1.50	12.00	3.1
1.55	12.00	2.98
2.00	12.00	2.9
2.05	12.00	2.83
2.10	12.00	2.78
2.15	12.00	2.76
2.20	12.00	2.75
2.25	12.00	2.75
2.30	12.00	....

High potential test at 500 volts satisfactory.

Closing amperes, 1.55.

Closing volts, 5.00.

DATA FOR DIAMOND-H SWITCH

Gave no trouble and showed no signs of wear.

Heat run data

Time.	Volts.	Amperes.
1.30	12.00	7.2
.35	12.00	6.3
.40	12.00	6.2
.45	12.00	5.9
	(Coil smoking.)	
.50	12.00	5.7
.55	12.00	5.5
2.00	12.00	5.4
.05	12.00	5.4
.10	12.00	5.4
.15	12.00	5.3

High potential test was satisfactory.

Closing amperes, 4.5.

Closing volts, 3.5.

Conclusions

The Bijur switch is unsatisfactory.

The Hart switch and the U. S. L. switch are satisfactory for production.

The Diamond-H switch is considered to be a good production model, as it is completely waterproof, contains very few parts which are liable to get out of order, and should be cheaply made.

The U. S. L. switch contains more parts and will be considerably more expensive for production than is warranted by any advantage which it may have.

NAVAL and MILITARY AERONAUTICS

Army Planes Can Talk to Plant 50 Miles Away

Washington.—The use of radio telegraphy and telephony in the Army Air Service is becoming increasingly important. The Engineering Division at McCook Field, Daytan, O., is experimenting with many types of apparatus and making tests in the radio laboratory.

The new apparatus includes a 5-kilowatt spark transmitting set which has a range of about 1,000 miles, a 2-kilowatt tube set with a range of 600 miles, a 1-kilowatt telephone set with a range of several hundred miles and several smaller telephone sets.

In the course of the tests it has been found possible to carry on a conversation between the radio laboratory and planes in the air 50 miles away as readily as between two stations on a ground line.

Radio also is being used in the Air Service for the purpose of assisting in navigation, particularly in the case of "above-the-clouds" flying.

Army Flyer Makes Unusual Landing

San Francisco.—When his engine suddenly stopped 15,000 feet in the air above remote Crater Lake, Oregon, Raymond G. Fisher, Forest Service pilot, was forced to land on a tiny island in the lake, which is in the pit of an extinct volcano with walls 1,000 feet high surrounding it, forestry officials announced here today.

The plane was not damaged in the descent, but Fisher upon examination found four of the spark plugs of the engine broken.

Using the wireless set with which the machine was equipped he succeeded in getting in touch with another Forest Service plane.

This second flyer hastened to Medford, Ore., and obtained new spark plugs for Fisher's plane. Arriving back at the lake, however, the rescue pilot found it impossible for another plane to land on the island or apparently to get the plugs to Fisher. Other Forest Service planes came up and sets of spark plugs were sent to earth by means of parachutes. Hunting with a torch Fisher found one of the parachutes and repaired his machine and "took off" from the island, reaching the Forest Service aeroplane base at Medford safely.

Mr. Bull Frog Takes a Joy Ride

From the Philippines comes a story of how a daring and intrepid bull frog nonchalantly leaped into the cockpit of one of Uncle Sam's aeroplanes and sat through the whole gamut of stunts known to "aeroplane stuntdom" without blinking an eye, acting as though he had been an old veteran in the game.

A few days ago Lieut. C. L. Webber was obliged to fly to Manila. After transacting his business he returned to Paranaque Beach, having failed to toss a single libation to Hymen. With due circumspection and thoroughness he proceeded to give his chariot the "once-over". She appeared to be a model of perfection, whereupon he vaulted into the cockpit and pushed off with never a qualm.

He had climbed to two thousand feet and his rythm of motion was purring her "sans souci" to him, when out of the corner of his eye he thought he detected untoward activity in the cockpit. He lowered his head, but could not be sure. He removed his goggles, but still doubt remained. He withdrew his handkerchief and gently caressed his eyes to remove all fauna or flora that might have inadvertently crept therein. He finally centered his gaze upon his rudder bar, for thereon benignly sat a huge bull frog, who intermittently grinned and ogled at him. He opened his throttle and zooned, but Mr. Frog was not perturbed. He sideslipped, he fish-tailed, he banked, and he did wing-overs, but his fellow passenger manifested not the slightest interest, nor would he quit his position on the rudder bar.

At this point Lieut. Webber reports detecting a violent knock in the motor. Soon a miss, first on one side and then on the other developed. He looked at his wings, and they appeared to wobble badly. He thought the ship had developed the ague or the Saint Vitus Dance, she vibrated so terribly. One moment he was positive the motor had stopped, the next he was equally certain his controls were fouled. All the time he was conscious of nothing but rice paddies flying by beneath him.

Lieut Webber finally landed safely on his home field, but before the ship came to a stop a person was seen to leap from the cockpit and run madly to the Flight Surgeon's Office. Fortunately, a psychiatrist was also present in the latter's office. The two after listening to an incoherent mumbling of "bull-frog, bull-frog" proceeded to a minute examination of the ship, whereupon they pronounced the case a very rare one, known as "bull frog on the brain".

Lieut. Webber is now slowly convalescing. He says he would be quite well were it not for the propinquity of his copassenger, who persists in hanging about his quarters at night.

North Island Additions

According to word received at North Island Thursday morning, a $30,000 appropriation was received to cover the cost of three hangars, each 100x300 feet, for land machines of the Martin Bomber type. In addition $20,000 has been appropriated for a storage house and a distributing supply house. Forty thousand gallons of gasoline will be stored.

Work on the new machine shop will soon start, and a new fire house will also be erected.

Radio

The use of radio telegraphy and telephony in the Air Service is becoming increasingly more important, as shown by the radio activities of the Engineering Division at McCook Field. Many types of radio apparatus are being tested and experimented with in the Radio Laboratory. In fact, there is probably no more completely equipped Radio Laboratory in the country than the one at McCook Field.

Work at this time is being done on various types of apparatus, including a 5-kilowatt spark transmitting set which has a range of about 1000 miles, a 2-kilowatt tube set which has a range of about 600 miles, a 1-kilowatt telephone set which has a range of several hundred miles, as well as various smaller radio telephone sets which have ranges of from 15 to 100 miles. In addition to this apparatus, tests are also being conducted with telegraph and telephone apparatus which is used on aeroplanes and includes a telegraph set having a range, from aeroplane to ground, of 100 miles and various telephone sets having a range of from 15 to 100 miles. Thus in the course of tests it is possible to carry on conversation from the Radio Laboratory with an aeroplane which is flying at a distance of 50 miles from the field as easily as it is to carry on conversation over the ordinary wire telephone from the house to the office.

In addition to communication, radio is also being used in the Air Service today for the purpose of assisting in navigation, particularly in the case of "above-the-cloud" flying. By means of direction finding loop stations located on the ground, it is possible to ascertain the bearing and the location of any aeroplane that is flying in the vicinity. Thus, if an aeroplane is flying above the clouds and is in doubt as to its exact location, the radio operator in the aeroplane calls these ground direction finding stations and asks that he be informed as to his whereabouts. These ground direction finding stations immediately take bearings on the aeroplane, and by means of triangulation determine its location. This information is then transmitted to the aeroplane by either radio telephone or radio telegraph.

By means of special radio direction finding loops installed on an aeroplane, it is possible to fly directly towards any radio transmitting station. Thus it is possible for aeroplanes to rise above the clouds and to fly directly to another station without seeing the ground until its arrival and landing.

Manual on Navy Aviation

In order that line officers of the Navy may have an opportunity to study aviation, the Bureau of Navigation has approved the plan for the compilation of a manual on the general subjects of aviation, organization, activities, aeroplanes, engines, equipment, use aboard ship, and other details. When this manual has been compiled and approved, it will be issued to the line officers of the Navy, and thereafter questions on aviation based upon the general subject as treated in the manual, will be part of the examination of line officers. The plan is now under way, but it is not expected that either the manual or the questions for examination will be ready for issue much before the first of next year, or possibly later. A tentative series of questions was submitted to the Bureau of Navigation as an outline of the subject which should be covered in the new manual.

FOREIGN NEWS

Air Route Over Desert

Regions that would have to wait many years before they could be traversed by railways are now quickly mastered by aerial transport. News cames from the British Air Ministry that a new air route has been opened up across the desert between Palestine and Mesopotamia. Notification has been received of the arrival at Bagdad of three aeroplanes of the Royal Air Force which have flown over this route.

The new route is about 580 miles long. It is an extension of the present Cairo-Ramleh route. It starts from Ramleh, where is the main Royal Air Force aerodrome in Palestine, passes through Amman (east of the Jordan) and Kasr Azrak, where landing grounds have been prepared, and proceeds thence in an almost straight line across the Arabian desert to Ramadie, on the Euphrates, and thence to Bagdad.

The distances between the principal stations are as follows: Ramleh to Amman, 65 miles; Amman to Kasr Azrak, 55 miles; Kasr Azrak to Ramadie, 400 miles; Ramadie to Bagdad, 60 miles.

Austrian Helicopter Tested

An article in "The Sphere" states that authentic news has recently reached London of the successful trials of an Austrian helicopter, invented by Lieut. Stefan von Petroczy. This machine has reached an altitude of approximately 160 feet, carrying two men, and flying straight up from the ground by the aid of two larger propellers measuring 21 feet in diameter. The propellers are driven by three rotary air engines working at a speed of 600 revolutions per minute.

Though experiments are taking place in various countries to solve the great problem of vertical flight, this is the first real success in this direction; and the height attained by the Petroczy machine puts it far ahead of its rivals. It is an event in the science of flight as important in its way as the first power-driven flight of the Wright Brothers.

When the helicopter is a proved success, the aircraft of the near future will be able to do without the large aerodromes necessary today. The Petroczy machine is also provided with a large parachute, which at the first sign of engine failure is automatically released, and able to bring the machine safely to the ground.

Shopping by Aeroplane

The latest fad among women in England is to make shopping tours by aeroplane, and they appear very enthusiastic about it, seeming to greatly enjoy every moment they are in the air and manifesting keen delight in the luxury the new aeroplane cabins afford. For their benefit largely the saloons bear dainty flower vases and mirrors.

Paris is the destination of most of the women. By going in a morning express one can now do an hour or so's shopping in Paris and catch a machine back which will bring one to the London air station in time to motor to town for dinner. From one express in from Paris the other evening there emerged eight women and only one man. Two women who wanted to buy a good many things in Paris hired a special "air-taxi," went over in the morning, spending the whole day there, and returned by the scheduled aeroplane express the next morning.

A Flying Boat's Work in Australia

Piloted by Capt. Lang, of the Australian Air Force, a fine four months' cruise on the S.E. coast of Australia has, according to a *Morning Post* correspondent, just been concluded. The "Seagull," the flying boat in question, is privately owned, although she has apparently been doing valuable national survey work, as during her trip all bays and inlets have been photographed and the flying conditions up to 2,000 ft. between Sydney and Tasmania have been tested, with especial attention to the islands in the Bass Strait. The "Seagull" carried on most of the cruise three men, an anchor, and an amount of small equipment, and was accompanied by the motor schooner *Acielle*, which was fitted out with a dark room. During the cruise an officer from military headquarters joined Capt. Lang with secret instructions, which were successfully carried out.

The "Seagull" remained the whole time absolutely unsheltered, took off from all sorts of seas, and outrode several gales (one lasting six days) on her own anchor. Almost constant high winds were found at 2,000 ft., although at the same time it was often dead calm at sea level. The pilot is specially pleased with the boat's behavior in the stormy wintry weather experienced in the Bass Strait. There was no accident throughout the voyage. The "Seagull" is fitted with a 160 h.p. Curtiss engine, measures 29 ft. over all, with a 51 ft. wing-span, weighs two tons, and flew fully laden on a four hours' non-stop flight against a stiff wind at the rate of 55 miles an hour, consuming on that occasion a total of 32 gallons of petrol.

Aviation in West Indies

Once or twice we have referred to the aviation developments, which give promise of materializing in the West Indies, and progress appears to be well in hand. According to a *Times* correspondent, the Bahamas House of Assembly has not only favorably considered a petition from the Bermuda and West Atlantic Aviation Company, asking for a grant of certain subsidies and concessions for the establishment of an air service between Nassau and Miami (Florida) and Nassau and the Out Islands of the group, but is also considering a bill to enable the Governor-in-Council to enter into a contract with the company for the projected service. The company, while identified with the Bermuda concern, will shortly be known as the Bahamas and West Atlantic Aviation Company. Later on both will be registered in London as the West Atlantic Aviation Company, the operations of which will extend from Bermuda to Trinidad. The proposals placed before the Bahamas Legislature include: A subsidy of £5,000 per annum for five years for a daily air service to Miami during the winter and a bi-weekly service for the remainder of the year, the inter-insular service to be provided as required. The local press favors the proposal, and it is pointed out that the colony has everything to gain commercially from such a service, while from the Imperial point of view the colony's duty is to lend support and encouragement to civil aviation.

Italian Government Orders Machines

According to the *Italian Press*, May 10, 1921, the Fiat Company is to supply to the Italian Government two A. R. F. machines, to be followed by two machines (probably the three-engined type) seating 12 passengers, and two machines seating four passengers. Moreover, the Fiat Company is to overhaul all the A.14 engines, fitting them with all recent improvements.

The Ansaldo Company is to supply two A. 300 C., and it is said that an order has been placed for a new squadron of 450 h.p. Caproni machines.

Two S. 13 *bis*, two S. 16 and two S. 16 *bis* have been ordered from the Savoia, and the firm is to undertake the repair of a quantity of naval aviation material.

Gnome Engine Works Destroyed

From Paris it is announced that the Gnome engine works at Argenteuil were destroyed by fire.

French Aviation Firms Are Now Consolidated

Three of the biggest French aviation companies: Astra, Nieuport and the Compagnie Generale Transaerienne have united their forces, with a capital of $5,600,000, nominal exchange. The present offices and factory of the Nieuport company will constitute the headquarters of the new group, of which the general manager will be Marcel Thomas, at present with the Astra company, and chief engineer M. Delage, of the Nieuport company. The new group will be interested in both aeroplanes and airships, and has in hand an order for two hundred planes for the Japanese Government.

Urges French Aeroplane Fleet

Deputy Paul Benazet has introduced a bill into the French Chamber of Deputies which proposes to establish a fleet of 1000 aeroplanes suitable for war, but which can be operated commercially and therefore at little cost to the Government. The author of the measure called attention to the large and extensive aviation personnel of the Government.

British Imperial Air Service

Great Britain is contemplating establishing an air service with its possessions. It would be known as the "Imperial Air Service" and would carry passengers and mail between England, Egypt, India, South Africa, Australia and New Zealand.

The feasibility of the service as well as a recommendation that it be established has been reported on by A. H. Ashbolt, Agent General for Tasmania, and a number of experts. It is proposed a company be formed to take over and utilize airships, plant and equipment now in possession of the Government, which it is understood the authorities are ready to do.

The company would have a capital of £1,500,000, of which half would be issued immediately on the following plan of distribution: Indian Government, £100,000; Australia, £100,000; South Africa, £100,000; New Zealand, £50,000; Malay States, £25,000; general public, £375,000.

Inasmuch as airships, material and equipment are to be given by the British Government and not ranking as capital, Great Britain will have the option of taking up the amount allotted to the general public.

Suggested ports of call are London, Marseilles, Athens, Cairo, Bazrah, Bombay, Colombo, Singapore, Java, Perth, Melbourne, Sydney, Wellington, Mombassa and Cape Town. It is believed such a service would bring England within five days of India and within ten or twelve days of Australia.

Commercial Aeronautics in Europe

In a special dispatch to the New York *Globe* and Chicago *Tribune*, Hiram K. Moderwell states that the approaching abandonment on August 1 of airships as a part of the British military equipment has stimulated civil aviation. While some bitterly oppose such abandonment, asserting that the airship is an indispensable military arm, others show a keen interest in the government's offer to give its five airships and all the existing equipment worth $25,000,000 free to a bona fide British commercial company undertaking to operate them.

Plans already are well advanced for establishing regular airship service between England, Egypt, South Africa, India and Australia. This would bring South Africa and India within a five days jorney from London and Australia within a ten days' trip.

According to one scheme, a corporation would be formed with a capital of 1,500,000 pounds, England and the dominions contributing half of the capital stock in consideration of the service rendered. This would practically be a subsidy. It is agreed that in the experimental stage, the airships would be run at a heavy loss, but some experts insist that eventually they could be operated at a commercial profit on flights of 2,000 miles or more, meeting the competitive steamship rates.

Contemporaneously with the government's offer of the airships comes a government offer of a subsidy for commercial aeroplane lines to the Continent. Two British lines are now operating daily between London and Paris under a temporary subsidy arrangement, but the government eager to enlarge the service, has offered all genuine British commercial lines maintaining a daily service a subsidy of 25 per cent of the gross earnings for three years up to a total of 200,000 pounds (normally $1,000,000) annually. This is for routes between London and Paris, London and Brussels and London and Amsterdam, but it is expected that new routes will be added. The government also will build machines for commercial companies, renting them at 2½ per cent monthly of the cost, the machines becoming the property of the companies after thirty payments.

This offer is a belated effort to meet the competition of the heavily subsidized French lines. In the summer of 1920 the British aircraft traffic to the continent was four times as large as that of the other nations, but this year it has been only one-quarter as large. This is because the French government has instituted a subsidy system enabling the lines to operate roughly at half the cost. This almost put the British lines out of business, but an emergency subsidy enabled them to resume temporarily.

Perhaps it is not generally known how extensive regular commercial aviation has become in Europe in the last year. There are now two French lines between Paris and London, one running three planes daily each way. There are other daily lines between Paris and Brussels, Amsterdam and Rotterdam, Paris and Strassburg and between Bayonne, France, and Santander, Spain. There are also Dutch lines between Amsterdam and London and between Amsterdam and Copenhagen by way of Bremen and Hamburg; also Belgian lines between Brussels and London, Brussels and Paris and Brussels and Amsterdam. A French line makes four regular weekly trips between Toulouse, France, and Casablanca, Morocco, via Barcelona and other Spanish ports. Other French lines make three trips per week to Prague, two trips to Warsaw and also from two to four times a week between Toulouse and Montpelier and Marseilles and Montpelier and Nice.

ELEMENTARY AERONAUTICS *and* MODEL NOTES

Aeroplane Characteristic and Performance Table Eliminates Mathematical Calculations

THE table given below is the result of many calculations made for the purpose of determining the various speeds obtainable with different wing loadings and with different lift coefficients. Messrs. William Wait and George A. Page, who compiled the figures in the table, were engaged in figuring on the low speeds possible to obtain with light loading and high lift coefficients, as an aid in the design of a small plane of low horsepower. So that the results of these calculations could be compared one with another, they were set down in table form and extended to include wing loadings beggining with three pounds per square foot and listing the speeds at intervals of half a pound up to fifteen pounds per square foot. For these loadings the speeds are listed for coefficients beginning with .00001 and including all the coefficients up to .00036. These figures include about all the coefficients likely to be considered in the design of a small light aeroplane, yet it will be found to be complete enough to enable many characteristics to be determined of some of the larger planes.

To those who have occasion to use the table, its handiness will be self-evident. The figures were obtained by listing, within the limits mentioned, the results of the formula

$$\frac{{}^{2}\sqrt{\text{lbs./sq. ft.}}}{\text{ky}}$$

; that is, the cube root of the pounds per square foot, divided by the ky or lift coefficient. From this it will be seen the number of calculations necessary to arrive at a solution without this table. By comparing the various results obtainable at a given wing loading the selection of a wing section suitable for the desired speed is greatly simplified.

When two factors of the aeroplane's characteristics are known, the third characteristic may be found in the table. For example, when the loading in pounds per square foot is known or assumed, and the lift coefficient for the maximum angle of the wing curve is known, the table will show the corresponding speed in miles per hour that can be expected. Another use to which the table may be put is in discovering the lift coefficient necessary to carry a given loading at a given speed. Determinations can also be made which will assist in finding out the best incidence angles for high and low speeds, the amount of surface necessary to obtain different speeds, etc. After the head-resistance and speed have been calculated, the table will show what lift coefficient is required.

It will be observed that the figures in the table are lined up in mathematical progression. This is most evident in the speed of seventy-one miles an hour, which extends diagonally across the table. A careful observance of the arrangement of the figures discloses other points of symmetry and illustrates the comparative characteristics with about as much precision as a series of graphs or curves.

"Aeroplanette" Club Suggested

The organization of an association or club to foster the "Aeroplanette" or light-weight aeroplane, has been suggested by Mr. Cortlandt S. Parker, of 407 East 19th Street, New York City. As Mr. Parker expresses it, his idea is "to get as many people in and out of the air as safely and economically as possible." In this connection he believes that the formation of an association as mentioned above would greatly popularize the aeroplane.

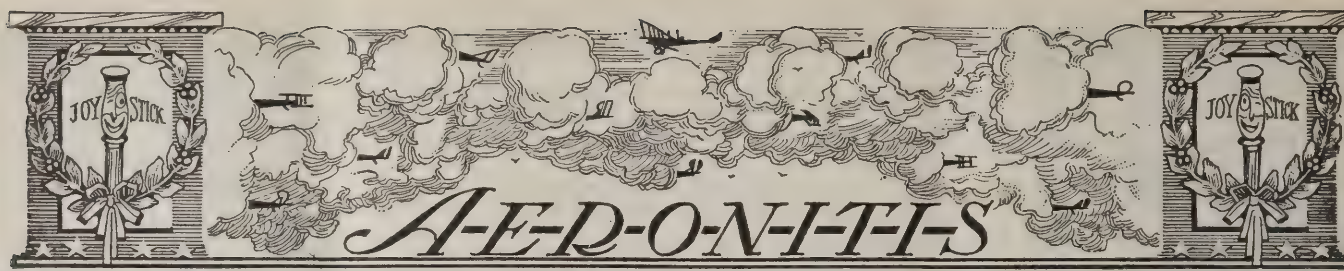
An organization formed along the lines of the "Federation of American Motorcyclists" would stimulate interest in aviation among the general public. Such matters as limiting the cylinder displacement of the engines and reducing the landing speed would help give the public faith in the efficiency and safety of a well-developed aeroplane, for as the motorcycle is to the automobile, the aeroplanette is to the aeroplane.

As many young men have sufficient experience to attempt the construction of a machine of this type, but have not the facilities for housing a large plane, an aeroplanette club would seem to present an ideal outlet for their talents. As there is no organization around New York City devoting its time to an idea of this nature, Mr. Parker would be interested in hearing from parties interested enough to assist in organizing such a club, with a view to building light aeroplanes of the type described.

LIFT COEFFICIENT (Ky)

LOADING IN POUNDS PER SQUARE FOOT — SPEED IN MILES PER HOUR

Loading	.00001	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	.00036
3	173	122	100	82	77	71	65	61	58	55	52	50	48	46	45	43	42	41	40	39	38	37	36	35	35	34	33	33	32	32	31	31	30	30	29	29
3.5	187	132	108	94	84	76	71	66	62	59	56	54	52	50	48	47	45	44	43	42	41	40	39	38	37	37	36	35	35	34	34	33	33	32	32	31
4	200	141	115	100	89	82	76	71	67	63	60	58	55	53	52	50	49	47	46	45	44	43	42	41	40	39	38	38	37	37	36	35	35	34	34	33
4.5	212	150	122	106	95	87	80	75	71	67	64	61	59	57	55	53	52	50	49	47	46	45	44	43	42	42	41	41	40	39	38	38	37	36	36	35
5		158	129	112	100	91	85	79	75	71	67	65	62	60	58	56	54	53	51	50	49	48	47	46	45	44	43	42	41	41	40	40	39	38	38	37
5.5		166	135	117	105	96	89	83	78	74	71	68	65	63	61	59	57	55	54	52	51	50	49	48	47	46	45	44	44	43	42	41	41	40	40	39
6		173	141	122	110	100	93	87	82	77	74	71	68	65	63	61	59	58	56	55	53	52	51	50	49	48	47	46	45	45	44	43	43	42	41	41
6.5		180	147	127	114	104	96	90	85	81	77	74	71	68	66	64	62	60	59	57	56	54	53	52	51	50	49	48	47	47	46	45	44	44	43	42
7		187	153	132	118	108	100	94	88	84	80	76	73	71	68	66	64	62	61	59	58	56	55	54	53	52	51	50	49	48	48	47	46	45	45	44
7.5		193	158	137	122	112	103	97	91	87	83	79	76	73	71	68	66	65	63	61	60	58	57	56	55	54	53	52	51	50	49	48	48	47	46	45
8		200	163	141	126	116	107	100	94	89	85	82	78	76	73	71	69	67	65	63	62	60	59	58	57	55	54	54	53	52	51	50	49	49	48	47
8.5		206	168	146	130	119	110	103	97	92	88	84	81	78	75	73	71	69	67	65	64	62	61	60	58	57	56	55	54	53	52	52	51	50	49	49
9			173	150	134	122	113	106	100	95	90	87	83	80	78	75	73	71	69	67	65	64	63	61	60	59	58	57	56	55	54	53	52	51	51	50
9.5			178	154	138	126	117	109	103	97	93	89	86	83	80	77	75	73	71	69	67	66	64	63	62	60	59	58	57	56	55	54	54	53	52	51
10			183	158	141	129	119	112	106	100	95	91	88	85	82	79	77	75	73	71	69	67	66	65	63	62	61	60	59	58	57	56	55	54	53	53
10.5			187	162	145	132	122	115	109	102	98	94	90	88	84	81	79	76	75	73	71	69	68	66	65	64	62	61	60	59	58	57	56	55	55	54
11			192	166	148	135	125	117	112	105	100	96	92	89	86	83	80	78	76	74	72	71	69	68	66	65	64	63	62	61	60	59	58	57	56	55
11.5			196	169	152	138	128	120	115	107	102	98	94	91	88	85	82	80	78	76	74	72	71	69	68	66	65	64	63	62	61	60	59	58	57	57
12			200	173	155	141	131	122	117	110	104	100	96	93	89	87	84	82	79	77	76	74	72	71	69	68	67	65	64	63	62	61	60	59	59	58
12.5			204	177	158	144	134	125	118	112	107	102	98	94	91	88	86	83	81	79	77	75	74	72	71	70	68	67	66	65	64	63	62	61	60	59
13				180	161	148	136	127	120	114	109	104	100	96	93	90	87	85	83	81	79	77	75	74	72	71	69	68	67	66	65	64	63	62	61	60
13.5				184	164	150	139	130	121	116	111	106	102	98	95	92	89	87	84	82	80	78	77	75	73	72	71	70	68	67	66	65	64	63	62	61
14				187	167	153	141	132	125	118	113	108	104	100	97	94	91	88	86	84	82	80	78	77	75	73	72	71	69	68	67	66	65	64	63	62
14.5				190	170	155	144	135	127	120	115	110	106	102	98	95	92	90	87	85	83	81	79	78	76	75	73	72	71	70	68	67	66	65	64	63
15				194	173	158	146	137	129	122	117	112	108	104	100	97	94	91	89	87	85	83	81	79	77	76	74	73	72	71	70	68	67	66	65	65



Dimmed His Lamps

"You say the glare of his headlight confused you. Weren't his lamps dimmed?"

"They were after I got through with him," said the man who had the narrow escape. "I gave him such a nice pair of black eyes that he could hardly see out of them."

—*Boston Transcript.*

The Reason Why

The sailor getting his hair cut noticed that Jerry, the Captain's dog, was lying on the deck beside the chair, and had his eyes fixed on John, the barber, who was at work. "Nice dog, that," said the sailor.

"You bet he is," said John.

"He seems very fond of watching you cut hair."

"It ain't that," said John. "You see, sometimes I make a mistake and snip off a little bit of a customer's ear."

Jimmie—"Say, Top, was that hair tonic you had in that bottle?"

Johnny—"No, that was mucilage."

Jimmie—"Then it is no darn wonder I can't get my hat off."

Phew!

He stood on the banks of the leaping brook,
His senses nearly reeling;
And now and then he would venture a look—
The village belles were peeling!—*Punch Bowl.*

See the Pilots swiftly winging,
Soaring upward to the sky,
White winged planes through cloudland swinging,
Swifter than the swallows fly.

When the morning light is breaking,
Bird men soar away with mails,
Mammoth planes the skyway taking,
With their loads of costly bales.
Unobstructed is the skyway,
Pilots spurn the earth and sea,
E'en the smoothest, broadest highway,
Is not so untrammeled, free.

Bird men over all the nation,
Dropping down from purple skies,
Gliding to their destination,
As the daylight fades and dies.

Oft' I gaze with rapture burning,
On the soaring planes on high,
As I wait intensely yearning
For the day when I shall Fly!

Paul Xavier.

"Come indoors immediately," called the nurse to a small boy whose father was going out. "You won't go to heaven if you are so naughty."

"I don't want to go to heaven," was his grievous reply; "I want to go with father."

Just a Sucker

She: "I met a fellow last night that was a regular cavalier."

Sailor: "What's a cavalier?"

She: "A handsome young man who takes a young lady to the theater, takes her to dine, brings her back in a taxi, and sees her to the gate, and says goodnight, without even asking her for a kiss."

Sailor: "We don't call them cavaliers."

She: "No? What do you call them?"

Sailor: "Just plain SUCKERS!"

In the Air

By Contact

Up, up to the sapphire sky,
Climbing, climbing as I go,
Up to where my dreams all lie,
Far from Mother Earth below.

Leaving man and earth behind,
In my faithful silver bird.
Up, with the aspiring wind,
From the earth scarce are we heard.

In the air, how can it seem
To wing your way on high?
Ah, 'tis almost a dream—
To race across the sky.

The towns and woods seem small,
The hills and streams yet smaller still,
And the earth: it hardly moves at all,
As the motor roars on with a will.

The clouds: they are never the same.
Some have a softer hue,
Than my faithful silver plane,
Cruising this sea of mystic blue.
And the wings, those man-made wings,
Which weather the wind and storm.
And each wire in turn sings,
As onward I am borne.

Up into the sapphire sky,
Flying, flying as I go
Here is where my dreams all lie,
Far from Mother Earth below.

(Copyright, 1919, New York Tribune Inc.)

TRIALS OF EARLY AVIATION ('TWAS EVER THUS)

AERIAL AGE WEEKLY

OL. 13, No. 23 AUGUST 15, 1921 10 CENTS A COPY

Airscape of the Oklahoma State Fish Hatcheries, near Fort Sill, Okla., Photographed by C. W. Brown

Aeroplane Carriers — Aeronautics in German Universities

LISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY

G. DOUGLAS WARDROP
Editor
B. C. BOULTON
Contributing Technical Editor
G. F. McLAUGHLIN
Contributing Technical Editor
NORMAN E. JENNETT
Art Editor
H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

Published weekly by THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, *at the Post Office at New York, N. Y., under the Act of March* 3, 1879.

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIII NEW YORK, AUGUST 15, 1921. NO. 23

Aeronautics in German Universities

GERMANY is proverbially thorough in all she does, and there are strong indications that this characteristic is to be applied to the future of aeronautics. Keen interest is being taken in the subject, and it seems to be realized that in order to develop properly it is essential that the scientific side, as well as the practical, must receive close attention. An important memorandum dealing with the subject of aeronautical instruction at the Universities has recently been worked out by the Committee for University Questions of the Hanover Technical College, and contains a number of important suggestions which, it is submitted, must be carried out if German aviation is to be developed on a similar scale. It suggests:—

That a chair of aeronautics and aircraft construction be introduced as soon as possible at at least one Prussian technical college.

That these chairs be equipped with laboratories and practice installations, and, by means of adequate assistance from the State, be placed in a position to guarantee a thorough experimental and, where necessary, also a practical training for the aeronautical engineers of the future.

That the existing institutions for instructional and research purposes be developed, and in the event of their being united with a chair, that a special current grant be made.

That relation with the research and test laboratories outside the university be furthered by means of State grants, so that the museums and installations may be utilized in the university course.

That, above all, aviation should take its rightful place in university and continuation courses for engineers and teachers, and be included in the normal curriculum (applied physics, etc.) more than hitherto.

All of these suggestions are admirable, and are well worthy the close attention of our own University authorities.

Aeroplane Carriers

ONE lesson that all observers have read in the Ostfriesland bombing tests is that the navy needs aeroplane carriers. An old vessel of one of the subsidiary classes is being refitted to carry planes. But it is neither large enough nor fast enough for such service.

Secretary Denby says that he will recommend to Congress an appropriation of $25,000,000 for the construction of two up-to-date aeroplane carriers. Unfortunately, the department didn't exert its influence sufficiently when the naval appropriation bill was up to strengthen the third or air arm of the navy. It apparently preferred that $90,000,000 should go for capital ships. It is true that the Senate amended the House bill by making provision for two aeroplane carriers. But the Senate also increased the total carried in the bill from $396,000,000 to $494,000,000. That wasn't the way to get carriers authorized.

The House was determined that not more than $400,000,000 should be spent on the navy in 1921-'22. The Treasury's necessities made it inadvisable to spend more than that. But the House was too strongly bent on completing the 1916 building program. It might have dropped out one or two battleships. It didn't, however. So when the Senate added the two aeroplane carriers it made the tactical error of not substituting them for other capital ships on the construction list. That would have forced a clear issue on which the Senate was right and the House was wrong. By adding $98,000,000 to the naval bill total it forced an issue on which it was wrong and the House was right.

The bombing tests didn't develop anything very surprising, except to the ultra-conservatives, who have been so influential in shaping our naval policy. It was evident a year ago that we ought to build plane carriers. If Secretary Denby now asks Congress to order them built he can easily carry his point if at the same time he recommends the diversion to their construction of some of the money now allotted to superfluous battleships.—Editorial in N. Y. *Tribune*.

The Right Man

THE Society of Automotive Engineers is to be complimented upon being able to secure so excellent a man as Dr. H. C. Dickinson of the Bureau of Standards to act as manager of its new research department. There are few men with such a fund of information or so keen an appreciation of the value of research, and especially of fundamentals upon which all sound research work must be based.

The News of the Week

Army Planes to Bomb Another Battleship

Washington.—An independent bombing enterprise against naval craft is being planned by the Army Air Service. With the old battleship Alabama as a target and using missiles up to 4,000 pounds in weight, the army flyers hope to add a new chapter to the interservice controversy which recently resulted in destruction from the air of several former German war vessels.

The Alabama was selected for the victim following request of the army for a target ship. Acting Secretary Roosevelt has announced that the Navy Department is dismantling the vessel and will be ready to turn her over to the land and air warriors about September 1.

With the event exclusively an army affair, it was said efforts would be made to simulate battle conditions when the Alabama comes under fire. For that purpose the army asked that the ship be turned over in sea-going shape, absolutely watertight, bulkheads sound, steam in her boilers and ventilating and communicating systems in working order. Request also has been made that her magazines be filled with full loads of powder and that in all respects except her useful offensive armament, which is being salvaged, she be ready for action.

It was said that a definite reply from the navy as to the extent to which the Alabama would meet these conditions when turned over had not been received, nor were the army men hopeful that they could obtain radio control equipment for her similar to that successfully employed on the battleship Iowa during the recent bomb tests. It is hoped, however, to have the ship in motion, probably under tow, when the army airmen open their attack.

Army plans call for all phases of air attacks at sea. Everything from the 300-pound bombs similar to the first rained on the German dreadnought Ostfriesland to missiles double the size of the 2,000 pounders which sent her down will be employed, it was said, and in addition smoke and gas bombs will be hurled at her decks from above. Several new projects of the Chemical Warfare Service are to be tested out against the Alabama, and penetrative qualities of the gases will be measured by means of the ventilation system of the ship.

The Air Service also plans to attack the Alabama with torpedo planes. In this phase naval airmen may be asked to participate, it was said, as army development of the air torpedoes is not regarded as fully satisfactory.

The Alabama is a much older ship than was the Ostfriesland, but protected by armor varying from 16½ to 9 inches in thickness, as against 11¾ to 6¾ on the German craft. The protective decks are about the same.

Air Meet in Colorado

Colorado's first aero meet was held by the Colorado Aero Club July 30, 31st, August 1st and 2nd on the Curtiss-Humphreys field at Denver. It was a distinct success. The meet was originally to have been terminated on August 1st, but owing to the large program and the enthusiasm displayed by both the entrants and the spectators, the fourth day was added. The attendance for the entire meet was close to three hundred thousand. There were presented eight cups and $2,500 in cash prizes.

The tone of the meet throughout was safety. Stunting, when performed, usually prevailed at a safe altitude. The officials of the Colorado Club and The Aerial Navigation & Engineering Company have in this way done a great deal for the aviation industry.

The planes attending represented almost every type manufactured in America. The Laird Swallow, piloted by "Buck" Weaver, proved to be the most popular ship on the drome. The performance of this plane was indeed a revelation to the citizens of the "City a Mile High."

A banquet was held at the Brown Palace Hotel on August 1st. Mr. C. A. Johnson, president of the Colorado Aero Club, presided. The addresses were made by Jerry Vasconcelles, N. H. Steele, Don Hogan, Captain Underwood, Harry Ruffner and Al Lendrum.

Navy Blimp on Joy Ride

The H-1, the Navy Air Service smallest blimp, went on a rampage from the air station at Rockaway Park, L. I., catapulted the pilot and crew of two into a Barren Island swamp when they attempted to bring it to earth, and, after drifting at a height of 5,000 feet for more than three hours, ended an unpiloted journey of fifty miles by landing gracefully on a farm near Scarsdale, N. Y.

Lieutenant Charles Bauch, test pilot; Machinist E. A. Sullivan and Chief Aviation Rigger D. A. Kenny floundered in the mud, bruised and cut by their precipitate fall, and were later taken to the Air Station hospital, where it was said that their injuries were not serious.

Lieutenant M. S. Eddy in a plane and enlisted men in motor trucks pursued the unruly blimp to its landing place. A good part of the population of Scarsdale, attracted by the sight of the balloon cavorting mysteriously over their city, raced after it as they saw it suddenly begin a graceful descent. After narrowly missing a church steeple and a couple of flagpoles in its descent, the H-1 finally settled down to earth without a jar. As the runaway touched the field a score of men made her fast with ropes to a tree and waited the arrival of the navy rescuers.

Wright Corporation Declares Dividend

The directors of the Wright Aeronautical Corporation at their meeting declared an initial dividend of 25 cents a share on the 224,390 shares of capital stock now outstanding. It is presumed that with a continuance of its present earnings the stock will be put on a regular annual dividend basis of $1 a share.

The report of the company for 1920 showed net earnings after all deductions of $411,349, equal to $1.88 a share on the stock. The gross sales were $1,486,000. It is stated that the company at the present time has $3,000,000 in orders on its books, mainly for Government account, or double the amount turned out in 1920 and equal to one year's capacity.

Rolfe with Cuban Company

Monte Rolfe, well-known American pilot, is now chief pilot for the Cuban-American Aerial Transportation Co. The company is operating two Farman Goliaths and one three-passenger Farman and very many natives are taking advantage of the opportunity to make flights.

In the flying school operated by the company Curtiss JN's and Canadian Curtiss are used exclusively. All of the original French personnel of the company have been replaced by Americans.

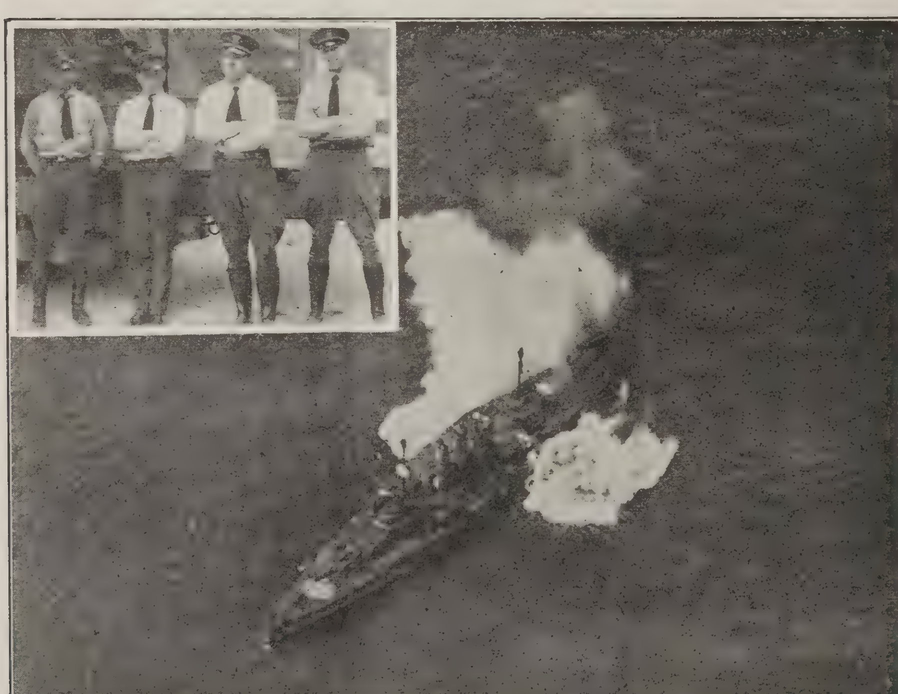


Photo U. S. Naval Air Service

The full force of nine bombs dropped by Naval Aviators comprising Fourth Division caused former German battleship Ausfriedland to sink. Insert: Fourth division (left to right) Lieut. D. H. Musk, Lieut. J. M. Sheehan, Lieut.-Commander J. H. Stoney and Lieut. M. F. Eddy

ZR-2 to Start on Trans-Atlantic Trip August 25

Washington—The American Navy's great new rigid airship, the ZR-2, just completed in England, will start its maiden flight across the Atlantic to the United States on August 25, according to an announcement at the Navy Department August 4. Under the guidance of Commander L. H. Maxfield, who will be in command of the twelve officers and thirty men of the navy in her crew, the huge dirigible will leave Howden, England, and head out to sea on the second aerial Europe to America trip in history, and land in Lakehurst, N. J., flying low to conserve gas and ballast.

The officers on this flight were announced as follows: Commanding officer, Commander L. H. Maxfield of St. Paul, Minn.; executive officer, Lieut. Commander E. W. Coil of Tucson, Ariz.; senior engineer officer, Lieut. Commander V. N. Bieg of Bryn Mawr, Pa.; navigator, Lieutenant R. G. Pennoyer of Berkeley, Cal.; watch officer, Lieutenant H. W. Hoyt; watch officer, Lieutenant J. B. Lawrence, U. S. N. R. F.; radio officer, Lieutenant M. H. Esterly, U. S. N. R. F.; meteorological officer, Lieutenant J. B. Anderson, U. S. N. R. F.; assistant engineer officer, Chief Machinist S. S. Haliburton; special duty, Lieutenant C. A. Tinker, U. S. N. R. F.

In July, 1919, it took the British airship, the R-34, 108 hours and 12 minutes to reach Hazelhurst Field, New York, from East Fortune, Scotland. The ZR-2, which is faster than the R-34, should make the trip in less time, provided the westerly winds are not too strong.

The ZR-2, the largest rigid airship yet constructed in any country, has a gas-containing capacity 300,000 cubic feet larger than that of the ex-German airship L-71, which was surrendered to Great Britain. The main dimensions and characteristics of the ZR-2 are as follows: Length, 695 feet; diameter, 85 feet 4 inches; capacity, 2,700,000 cubic feet; total lift under normal conditions, 86 tons; total horsepower, 2,100; engines, 6 sunbeam "Cossack"; normal crew (officers and men), 28 to 30.

Ostergaard Enlarges

The Ostergaard Aircraft Works have moved to new and larger quarters at 4269 North Narraganset Avenue, Chicago. B. J. Ostergaard reports business brisk.

Aeronautical Course at the University of Detroit

Feeling confident that Detroit will eventually become an aircraft and an aircraft equipment center and that the demand for men trained in aerial science will become greater as time goes on, the University of Detroit is formulating plans for the establishment of a 5-year course in aeronautics. Commenting on this latest innovation of the University of Detroit, Mr. F. W. Hersey in an article in the *Michigan Manufacturer and Financial Record,* raises the question as to whether or not it is possible to do the subject justice in that length of time. He feels, however, that the University of Detroit can produce aeronautical engineers of a caliber superior to any now known, judging by present standards of the University, adding that like medicine, law, chemistry, and the multitude of other sciences, theory in aeronautics is one thing and practice is quite another.

In the opinion of Lieut. Thomas F. Dunn, dean of the new Department of Aeronautics at the University, who was interviewed on the new course, there are two ways of getting an aeronautical education, one to go up in the air and gather some experience, and, if spared for future investigation, return to solid earth and tackle the theory. The other way is to tackle the theory first and then try it out on the air. To convey an idea as to the latitude of this course, the subjects to be taught in the aeronautical course are given, as follows: Higher mathematics, communication, mapping, astronomy, physics, meteorology, weather calculations, theory of flight, balloons, aerodynamics, aerostatics, aircraft mechanics, testing drawing, administration, chemistry, electricity, engineering principles, metal working, working design and construction, topography, wireless telephony and telegraphy, safety devices, uses of instruments, some commercial law, and all there is or will be on aerial navigation laws, principles of law as it will be applied to the air, and aerial photography.

Fokker May Locate in Hartford

There is a possibility that if the Netherlands Aircraft Corporation decides to establish an American factory for the manufacture of Fokker planes it will be located at Hartford, Conn.

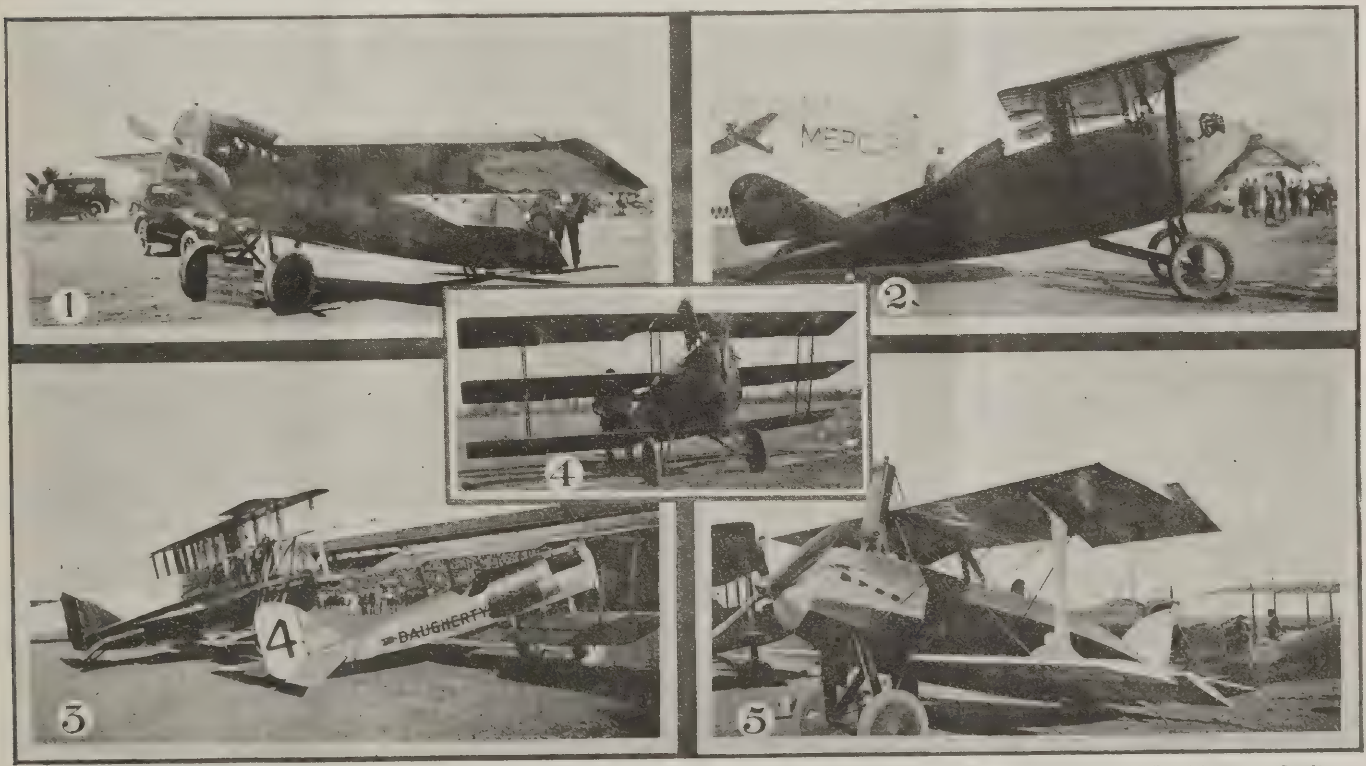
On Saturday (August 6) one of the six passenger Fokkers, piloted by Bert Acosta, visited Hartford and the passengers were greeted at Brainard Field, the municipal aviation center, by members of the Hartford aviation commission.

Robert B. C. Noorduyn and Fritz Cremer, the Fokker representatives in this country, visited the West Armory of the Colt's Patent Fire Arms Mfg. Co. plant, which was used during the war for the manufacture of the famous Browning guns. President Samuel Stone of the Colt Company is interested in aviation and the members of the Hartford commission and the Connecticut Chamber of Commerce would both encourage the location of an aircraft manufacturing company at Hartford.

The Fokker representatives were much impressed with the interest shown in aviation at Hartford. If the Fokker makers or some other aircraft company decides to locate in that city, a large section of the Colt plant is available, and is only a few hundred yards from the municipal field, which could be used for testing purposes.

A second Fokker plane, one of the three place express models, visited Hartford last week, arriving a few hours after the large plane, which remained until late Sunday afternoon.

Several members of the Hartford commission who went aloft in the big Fokker plane, were much impressed with its performance.



Some of the entries in the National Air Tournament at Los Angeles. 1. The Pacific Standard C1 monoplane; 2. The Mercury Gosline; 3. The Polson Special, Catron and Fish triplane and Daugherty biplane; 4 Catron and Fish triplane; 5 Catron and Fish special biplane

The AIRCRAFT TRADE REVIEW

A. E. J.

Williams-Hill Report Sales

In a recent communication Errett Williams, president of the Williams-Hill Airplane Co., Arkansas City, Kans., reports that his company has disposed of thirty-eight planes this year and that they have prospects for the disposal of forty more. All of the sales have been the result of straight and sane passenger carrying and the practical demonstration of the utility of aerial transportation in Kansas, Missouri and Oklahoma.

Aeronautic activities in Kansas have been put on a sound foundation by the passing of a state law which makes it possible for every city of over 3,000 population to own and maintain a municipal landing field at the city's expense. The State Aircraft Board is composed of the Adjutant-General as chairman, A. K. Longren of Topeka as inspector and Errett Williams whose duty it is to issue licenses to qualified pilots in the state.

Arkansas City is thoroughly alive aeronautically and has two landing fields and twelve privately owned aeroplanes.

A. M. E. A. Convenes Oct 5

New York, July 26—The annual convention of the American Manufacturers Export Association, which numbers several automotive manufacturers among its membership, will be held at New York on October 5 and 6, and various matters of importance will be discussed.

Wright Aeronautical Publishes House Organ

The Wright Aeronautical Corporation of Paterson, N. J., has started a monthly publication for the benefit of its employees. In its leading article is set forth the aims of the publication, which are threefold: First, to create good feeling in the "Wright family"; second, to bring about co-operation between the various departments whose combined work builds the Wright aeronautical engine; and third, to bring every Wright Aeronautical employee in contact with the entire world question of aeronautics.

From Hispano-Suiza to Wright

In an article in the first issue of the monthly house organ of the Wright Aeronautical Corporation the following interesting facts are presented concerning the Americanization of the Hispano-Suiza motor:

"If almost any one of us would sit down and think, he would find that he knows some man or woman who, though born on foreign soils, came to these shores at an early age and who has been so imbued with the American spirit and so changed in mind and soul that they are no longer anything but American.

"The Hispano-Suiza motor is a mechanical analogy of such a person. At an age early in its aeronautical life we brought it to America and have so surrounded it with the atmosphere of American engineering ingenuity and so imbued it with that "be the best" spirit which is the all-pervading thought of American industry, that it is no longer the Hispano-Suiza, but a thoroughly American product, to which we have given the good old American name of Wright, in honor of the progenitors of all flight.

"The old saying that nothing in this world can remain stationary is particularly true in everything pertaining to aeronautics. An aeronautical engine must change constantly; must be improved to meet the varying demands placed upon it by plane designers and by the needs of the Army and Navy Air Services.

"The corporation was well aware of the criticism against the Hispano to the effect that the valves were delicate and set about the solution of this problem. To illustrate the results obtained by the change in cylinder construction, one Wright engine has been running at Carlstrom Field, in ordinary flight, for more than 400 hours without overhaul.

"More than fifteen major mechanical changes and improvements have been made in the 'Hisso' by the Wright engineers.

"The early French engines had very thin heads in the cylinder sleeves and considerable trouble was experienced with the valves. At first the Wright engineers thought the trouble was due to valve warpage, but careful study revealed that it was due to cylinder head warpage. The thickening of the cylinder head did away with the thin plate or diaphragm action of the thin head and permitted expansion without warping. This elimination of warping assured the perfect seating of the valves.

"The valves themselves were also somewhat changed in design. The size of the neck was increased to allow a better heat flow away from the face of the valve, thus keeping it cooler and making it less likely to burn. The design of the cylinder block was changed to allow increased circulation of cooling water around the exhaust valve seats.

"The installation of American magnetos and an American ignition system was one of the first changes.

"The design of the pistons was altered completely. The piston pin was changed from the fixed to a floating type. The modified piston does not burn so easily, and is a better manufacturing job. The original Hispanos had a set screw which held the piston pin in place. This in service, due chiefly to the carelessness of mechanicians, was sometimes likely to drop out, often going through the head of the piston or through the bottom of the crank case. This permitted the piston pin to rub against the cylinder wall, scoring it and spoiling the motor until expensive repairs could be made. The floating type of piston pin, it has been found, gives better wear than the fixed type.

"Changes were also made in the connecting rod and bearing. The French inner connecting rod and bearing were integral with each other. This made the lightest possible construction, but defects were that the manufacture of these bearings were exceedingly difficult and their life in actual service very short even under the best conditions. The change to the Wright type gave a great increase in duration of this member, and also made a simpler manufacturing operation.

"A new carburetor for the Hisso was also developed. The new carburetor has many merits, but the most important is the more complete control of the mixture. This is especially useful in altitude work.

"Several changes were made in the magneto bracket until a modification was obtained which made it possible to use a straight engine bed in the plane, simplifying removal and replacement. A change in the vertical shaft which made for greater ease in manufacture and in timing was also made.

"The French design of the lower half of the crank case was for a wet sump meter, that is, one carrying its own oil in the lower half of the crank case. On steep dives or steep climbs this meant there was danger that the cylinders in front or in the rear would be flooded. The first American modification was to use an auxiliary oil pump placed on the rear of the magneto bracket to make the meter a dry sump job. This was found to be only a makeshift. A later design placed all oil pumps together in a compact unit, easily accessible and properly placed. An oil lead from the front end of the camshaft housing was run back down to the crank case to take care of overflow oil when the plane is diving, as well as to prevent the camshaft housing from inundation and possible leaking down the valve stems.

"A slight change was also made in the upper half of the crank case in order to give oil a direct lead to the front thrust bearing. This improvement permits unobstructed lubrication of the bearing, which is very heavily worked and is also a precaution against possible trouble from partial failure of splash lubrication. The rear end of the crank case was slightly changed to accommodate the magneto bracket, which is interchangeable on the 180 and 300.

"The design of the water pump attachment and outlet was slightly modified to make them more compact and accessible. A fuel pump for handling gasoline without the use of a pressure tank and air pump has been provided on the bottom of the new magneto bracket, and provision has been made for the installation on the magneto end of the engine of a standard type electric starter.

"But although the 'Americanized' engine is, in the opinion of many aeronautical experts besides those of the Wright Corporation, as near perfect as is possible in this year 1921, the work of altering, improving and amending is going ahead as steadily on the Wright motor as on the old 'Hisso' from which it developed."

Platt-Margeson Aircraft Co. Organized

The Platt-Margeson Aircraft Co. has been organized at Quincy, Mass., and will engage in commercial aviation.

The personnel of the company is as follows: A. F. Platt, formerly R.A.F.; C. L. Margeson, formerly R.A.F.; H. P. Pinkham, formerly U. S. Air Service; H. J. FitzGerald, formerly U. S. Air Service; M. E. Bumpus, formerly U. S. Air Service; Mrs. Ada C. Ross.

The flying field of the company is located at South Hingham, and arrangements are being made for the use of a field in North Carolina for winter flying.

EXPERIMENTAL REINFORCED PLYWOOD TRUSS RIBS

THE purpose of this report is to summarize the work that has been done on the development of reinforced plywood truss ribs, comparing this type of rib with other types, and drawing conclusions from the test results in regard to data to be used in further design work.

The problem primarily has been to develop large ribs that should possess the following characteristics:

1. Adequate strength.
2. Minimum weight.
3. Low production cost.
4. Simplicity of construction.
5. Rigidity.
6. Reliability.
7. Economy of material.

Considerable work had already been done on large ribs, notably by the Forest Products Laboratory, Barling, Glenn L. Martin Co., and Handley-Page.

The Forest Products Laboratory has for two years been working on the design of ribs with a 15-foot chord for the Navy Department. Their first ribs were of the plywood web type. Tests of these ribs "indicated that it would not be feasible to build a rib of this length (15 feet) having a plywood web because of the greater weight of the web required to obtain the desired strength." The laboratory then turned their attention to truss ribs, and up to May, 1919, had made and tested 11 different designs comprising six types, known as the wrapped veneer strap, the twisted veneer strap, modified Navy design, simple Pratt truss, Warren truss, and double Pratt truss. A summary of the results of tests on these ribs is given in Table I. Loading 1 is a triangular loading with the apex of the triangle 25 per cent of the chord back from the leading edge. Loading 2 is the loading for the high incidence condition. It is triangular with the apex of the triangle at the leading edge.

TABLE I

Strength Tests on 15-Foot Aeroplane Wing Ribs

Design No.	Type.	Load distribution.	Number of tests.	W = average weight of ribs, pounds.	P = average total load sustained, pounds.	Ratio P/w. W = average weight of ribs, ounces.
1	Wrapped veneer strap.	Loading 1	3	2.70	496	11.5
2	Do.	Do.	2	3.60	772	13.4
3	Do.	Do.	2	3.45	854	15.5
4	Twisted veneer strap	Do.	5	3.16	447	8.8
5	Navy design (modified)	Do.	3	2.51	729	18.2
6	Pratt truss	Do.	5	2.45	700	18.0
7	Warren truss	Do.	3	3.63	850	14.5
8	Do.	Do.	3	2.97	748	15.7
9	Do.	Do.	3	2.90	849	18.3
10	Double Pratt truss	Do.	3	2.96	606	12.8
11	Warren truss	Do.	3	2.23	742	20.8
11	Do.	Loading 2	3	2.26	974	26.9

The conclusions of the laboratory regarding these various types are given below:

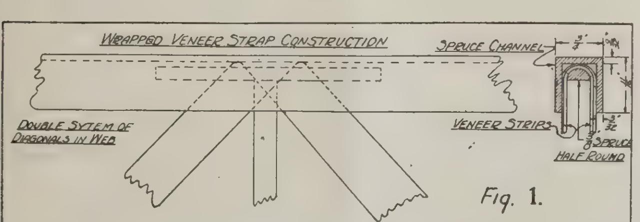


Fig. 1.

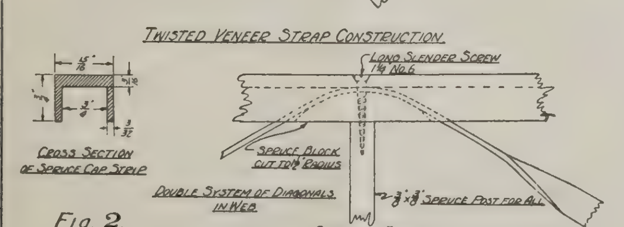


Fig. 2.

In the wrapped veneer strap construction, figure 1, the attempt was made to utilize the full tensile strength of veneer strips, the diagonal winding between continuous. Satisfactory strength was obtained upon the addition of channels over the cap strips, but the strength per unit weight of the rib, modified in this way, was below that of several other designs.

The twisted veneer strap rib, figure 2, failed repeatedly in the diagonal tension members where they are bent around small blocks in the channel cap strips. This weakness could probably have been remedied somewhat by steaming the strips before bending, but it did not seem probable that strength: weight ratios equal to those of some of the other designs could be obtained. The rib was also less stiff than ribs of several other designs.

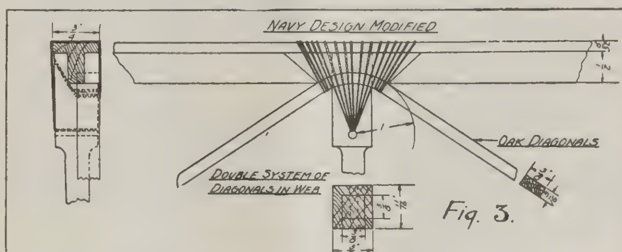


Fig. 3.

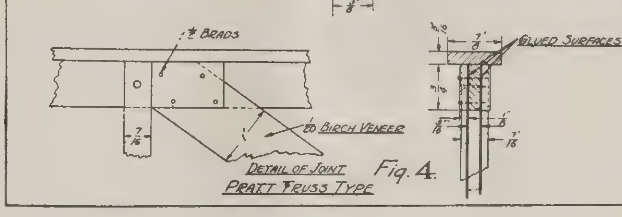


Fig. 4.

The Navy design of rib, figure 3, when modified, proved to be very light and also quite strong, but the time required in making it was much greater than that required in the preparation of other ribs equally light and strong.

The Pratt truss type, figure 4, gave very satisfactory strength per unit weight values. It was designed to develop the full tensile strength of wood by using thin strips of veneer for the diagonal members wide enough to provide adequate strength in the glued joint. Screws or nails contribute very little to the strength of joints of the type used in this rib, so that the glue must be depended upon for the strength of the rib. Ribs of this type will effectually sustain loads in one direction only.

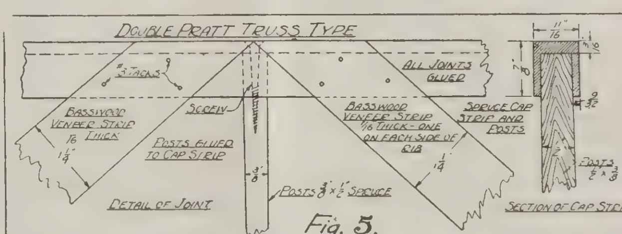


Fig. 5.

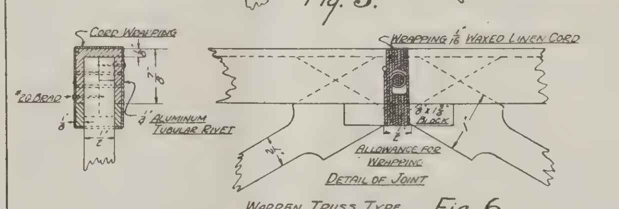


Fig. 6.

The double Pratt truss design, figure 5, was intended to overcome the objection of nonreversible loading. It, however, also depends upon glued joints for its strength. The strength per unit weight of this type of rib is not as high as that of the simple Pratt truss rib.

The best results with the Warren truss type of rib, figure 6, were obtained with the design in which all diagonals and cap strips were made of spruce. Ribs of this type may also be subjected to reversed loading. Considered from the point of view of maximum load per unit weight, the Warren truss rib was superior to any of the other types. It is relatively simple, and while it depends in part upon glued surfaces in the joints for strength, the lapped and taped construction of the joints

gives it considerable strength, should the gluing prove to be poorly done.

Three truss ribs designed by Mr. Barling were recently tested by the materials section of McCook Field. The general construction of this rib is shown in figure 7. The chords were each made of a single piece of spruce cut to a T section, while the web members were similarly each of one piece of

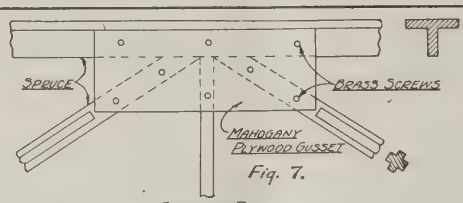


Fig. 7.

BARLING RIB

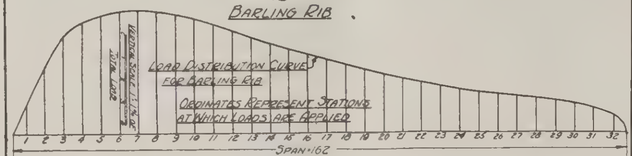


Fig. 8.

Fig. 9.
GLENN MARTIN RIB

spruce of cruciform section. Each gusset plate is attached with from two to eight small brass screws, there being about 230 screws in the entire rib. The test data for these ribs are given in Table II. The chord length of the Barling ribs is 162 inches.

TABLE II

Specimen.	Maximum load.	Weight in ounces.		Strength: weight ratio.		Center deflection.
		Original.	Final.	Original weight.	Final weight.	
						In.
1	915	34	31	26.9	29.5	0.36
2	1,115	34	31	32.8	35.9	.97
3	1,050	34	31	30.9	33.9	.45
Average	1,030	34	31	30.2	33.1	.59

These ribs showed a high strength: weight ratio. No failures occurred at the joints, which are the critical points with built-up ribs. The labor cost, however, on a rib of this type is very large owing to the great number of parts required and the difficulty of shaping so many of the members to the proper form. Furthermore, for this rib the type of loading, as shown in figure 8, was much less severe than the standard loading, except on the rear portion of the rib. Instead of applying all the loads to the bottom chord, which between the spars was in compression, only every third load was applied there and the others to the top chord, which was in tension between the spars. Since this system of loading considerably relieved the stresses, the values for the strength: weight ratio in Table II must be at least partially discounted.

The Forest Products Laboratory tested a number of commercial Handley-Page ribs and found them unsatisfactory. When modified to closely resemble the Forest Products Laboratory's simple Pratt truss rib, the Handley-Page rib was much improved. The best results on two of these modified ribs were as follows:

Weight.	Average load.	Strength: weight ratio.	Chord.
15 ounces	426	29	Probably 10 feet.

A triangular loading with the apex 25 per cent back was used. This rib was very light for its size but was of insufficient strength. It could not, moreover, sustain a reversed load and its strength is almost entirely dependent on the gluing.

The rib developed by the Glenn L. Martin Co. for use on the Martin bomber is a most remarkable rib. It was an outgrowth of the conventional plywood web type of rib with long rectangular cut-outs. The construction is shown in figure 9. The function of the X-web members is to carry shear. They are more effective in doing this than the verticals of the plywood web rib because all the grain of the X members is in the direction of the stress. Data from tests made at the Martin factory on this rib are given in Table III.

TABLE III

Weight.	Load.[1]	Strength. / Weight.	Chord.
Ounces.	*Pounds.*		
10	436	43.6	94
12	615	51.2	94
12¼	451	36.8	94
11.4	501	43.9	94

[1] Loading triangular with apex of triangle 25 per cent back.

Ribs of this same design have been tested by the Forest Products Laboratory with the results given in Table III-a.

TABLE III-a

Number of ribs tested.	Weight.	Load.[2]	Strength. / Weight.	Chord.	Deflection at maximum load.
	Ounces.	*Pounds.*			
Maximum	11.3	575	50.8	94	0.51
Minimum	11.7	447	38.3	94	.53
Average of 5	11.5	486	42.2	94	.53

[2] Theoretical high-speed loading.

The strength: weight ratio of these ribs is extremely high, but the great effect of the chord length on this ratio must be taken into account in comparing ribs with different chords. The law of variation for this ratio is not known, but it may be assumed approximately as the three-fourths power of the ratio of the chord lengths. The Martin ribs are simple to construct and are economical of material. They are admirably adapted for use on a wing with a comparatively light wing loading or a fairly close rib spacing. It is not believed that this type would be as satisfactory if a much greater strength were required. As the basic principle of the Martin rib construction is the same as that of the plywood web rib with long rectangular cut-outs, the fact that the latter type of rib proved unsatisfactory for a chord length of 15 feet would indicate that the Martin rib also would not be economical for chord lengths greater than 9 or 10 feet. Tests made at the Naval Aircraft factory on 15-foot ribs of the Martin type substantiate this conclusion.

Reinforced Plywood Truss Ribs

The principle involved in the design of ribs of this type is that by making the chord and web members integral, the difficulties experienced with built-up truss ribs in securing sufficient strength at the joints would be obviated. The manner in which this is done is illustrated by figure 10. One of the very important incidental features of such construction is the great saving in labor made possible by having web members of uniform section throughout their length, thus eliminating the careful fitting, gluing, and taping required in truss ribs of the

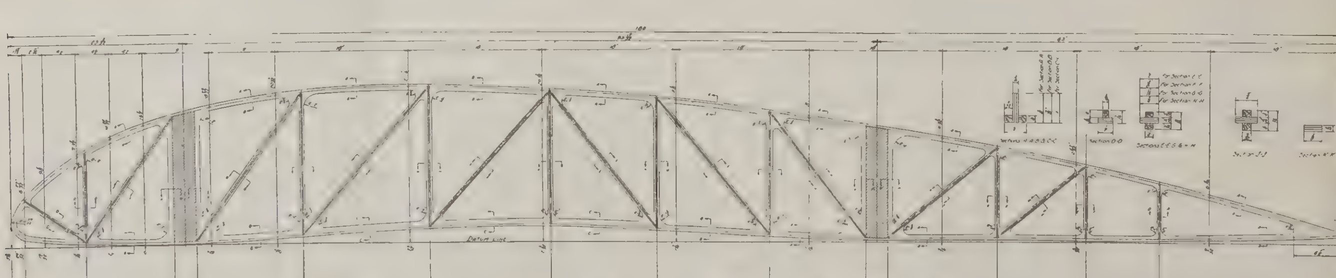


Fig 10

type shown in figure 6, and having the chords of a simple section. It will be observed that in most of the ribs so far discussed the chords members have been of a channel or T section, which is somewhat difficult to cut and which requires steaming to bend the portion at the nose.

The first ribs of this type to be designed had a chord length of 106 inches and were of the USA-18 wing section. In the design of these ribs, stress diagrams were made for the standard triangular loadings with the apex of the triangle at the leading edge, 25 per cent and 50 per cent back from the leading edge, and the most severe stresses used for each member. In addition to the direct stresses, the bending moments due to the test loads applied to the lower chord were computed, assuming the chord continuous beam between spars.

The design and test data on these ribs are given in Table IV.

Table IV

Rib.	Direction of grain of face plies.	Species of plywood.	Plywood thickness.	Rib weight.	Maximum load.[1] First.	Maximum load.[1] Final.	Load. Weight.	Maximum deflection at center.
	°		In.	Oz.				In.
1	45	Birch-poplar	1/8	18	410	925	51.4	0.450
2	45	Do.	1/8	18	550	925	51.4	.500
3	45	Do.	1/8	17½	540	....	30.9	.300
4	0	Do.	1/8	19	[3]650	850	44.7	[2].285
5	0	Do.	1/8	17	[3]650	750	44.1	[2].285
6	0	Spruce-poplar	1/8	15½	620	620	40.0	.440
7	0	Do.	1/8	15	575	575	38.3	.550

[1] Triangular loading with apex at leading edge.
[2] Maximum deflection under 650-pound load.
[3] No failure.

In the ribs with the grain of the face plies at 45° the chords members were all weak in bending, and not until they were reinforced could the strength of the rib be developed. Although these ribs were stiffer than those with the grain of the face plies horizontal they proved unsatisfactory because of the weakness of the chords, and the high value of the strength : weight ratio should be discounted. Ribs 3, 4, 5, and 6 proved to be entirely satisfactory just as they were. In all these ribs failures occurred in one of two panels in the lower chord and none in the web members. As the strength above 600 pounds of a rib of this chord length cannot be utilized, the slightly less efficient ribs with spruce webs are the best because of their lower weight.

A test on a reinforced plywood truss rib of the USA-27 wing section with a 65-inch chord is of interest. This wing section, even with a comparatively short chord, is too deep between the spars to permit the effective use of a standard Spanish cedar plywood web with circular cut-outs. In the truss rib designed there were only four diagonal members in the 26-inch space between the spars. This resulted in long bays and hence rather heavy chords, but cut down the number of parts. The plywood used was 3/32-inch 3-ply spruce poplar with the grain of the face plies horizontal. All cap strips and reinforcing were 3/16 by 3/16 inch spruce. This rib weighed 9 ounces and sustained a load of 500 pounds. A strength of 350 pounds was the maximum required, but it was impracticable further to cut down the size of the members. It is suggested that a rib of the Glenn Martin type of rib construction for the web and chords between the spars would be superior for small, deep ribs to the truss construction here described, for the reason that a lower weight of rib could probably be obtained.

(To be continued)

INSTRUCTIONS TO PILOTS FOR THE USE OF MIXTURE CONTROLS

Purpose of the Mixture Control

Most modern aviation engines are equipped with a device for controlling the supply of fuel to the carburetor jets under varying conditions, particularly those of altitude. These devices are known variously as "altitude controls," "pilot's control valves," "fine adjustment valves," "mixture control valves," etc. The purpose of all these valves is the same (although the particular manner of accomplishing the results may be different), i. e., to adjust the fuel flow at any set throttle opening for the best operation of the engine. This is particularly important at increasing altitude since the horsepower decreases rapidly as the air grows less dense or "thinner," whereas the fuel flow through the jets does not diminish at the same rate. This means that carburetors which are adjusted to give a proper mixture at sea level will give an excessively rich mixture at 15,000 or 20,000 feet. Since all engines are designed to run on a certain quality of mixture, excessive richness always results in a drop in power, irregular operation, spark plug fouling, and a decided waste in fuel.

Benefits to be Derived From the Use of the Mixture Control

By proper adjustment of the gasoline-air mixture entering the engine, with the control valve provided for this purpose (if the control functions efficiently), it is possible to obtain higher aeroplane ceiling, regular operation of the engine, and, because of the saving in fuel, a marked increase in cruising range.

The extent of the benefits to be obtained on the average engine can be appreciated from the following figures which are indicative of the results that can be obtained with a good control:

On a certain aeroplane equipped with a Liberty engine and a good type of mixture control it was possible to obtain at the service ceiling a 200 r. p. m. increase in speed of the engine, an increase in ceiling of approximately 2,000 feet, together with a 40 per cent saving in fuel.

It should be understood that results of this character can not be obtained on all service aeroplane engines, but even if marked increase in engine speed is not obtained, very often a considerable saving in fuel is effected without the pilot's knowledge.

When to Adjust the Control

In general, the mixture control should be left in the full rich position on a climb, after a take-off, until 3,000 or 4,000 feet altitude have been reached, to avoid possible irregularity in engine operation. In the case of fast-climbing aeroplanes where the pilot is busy with instruments, etc., it is permissible to leave the control in the full rich position until an altitude of 5,000 or 6,000 feet is reached.

After the first adjustment, the control should again be readjusted on the climb every 2,000 or 2,500 feet increase in altitude.

As the ceiling of the aeroplane is approached, it will probably be found necessary to adjust the control at smaller changes in altitude, possibly every 1,000 feet.

On the glide, especially where a considerable descent is contemplated, the control should be adjusted to the full rich position.

On cross-country or duration flights, irrespective of the altitude, the mixture control should be adjusted just as soon as the cruising altitude is attained. This is important, as the principal value of the control is as a *fuel saver,* as has already been noted.

How to Adjust the Control

The proper adjustment of the mixture control is not very difficult and should become fairly automatic with a little practice.

Before taking off, the pilot should make sure that his control is in the "full rich" position. Ordinarily, and in the more modern installations, this position is at the rear end of the control sector corresponding to the same position as is ordinarily closed throttle, retarded spark, etc. If there is some doubt as to which of the two positions is "full rich," this should be determined on the ground by moving the control successively to both ends of the sector. The "full rich" position should give regular "operation" and the greatest number of r.p.m. The "full lean" position should give the lowest r. p. m., and, on some engines, cause very irregular operation and possibly even stop the engine.

When the proper altitude is reached at which the first adjustment of the control should be made, the pilot should manipulate the mixture control as follows:

(*a*) Move the control *slowly* toward the full lean position. Watch the engine speed as this is done.[1] Keep moving the mixture control toward the full lean position until you observe that the engine speed begins to decrease. The point at which the engine is just about to drop its speed, but has not yet done so, is the ideal position of the control. Obviously this is the point at which the maximum horsepower is being obtained with the best fuel consumption. Beyond this point the engine speed drops because not enough fuel is reaching the jets, and operation under this condition may be actually wasteful of fuel.

(*b*) The pilot should note the position of his mixture control the moment that

[1]A good pilot should do this by listening to the sound of the engine in addition to watching the tachometer, as the standard tachometers have a perceptible lag.

the r. p. m. has first shown a drop. It will now be necessary to move the control back toward the rich position a considerable distance on the sector until the engine has regained its original speed and regular operation. When this has been done the control should again be moved forward slowly and stopped just before the point on the sector is reached where a drop in engine r. p. m. was obtained on the first attempt.

(*c*) Since the purpose of the control is to obtain the most horsepower with the lowest fuel consumption, it is obvious that if the control produces an increase in engine r. p. m. (which will not occur frequently except at the very highest altitudes) the control should be left at the leanest position at which the control gives the greatest engine speed.

At each change in altitude of approximately 2,000 or 2,500 feet, the mixture control should be readjusted, the general procedure followed for the first adjustment being repeated. Inexperienced pilots may at first have some difficulty in finding the ideal position for the control. In that event as many attempts as desired can be made at each altitude to find the proper adjustment.

Hints and Precautions

In adjusting the mixture control the following precautions must be observed:

(*a*) It is always permissible to move the control *quickly* from the lean to the rich position. It is *never* permissible to move the control quickly from the rich to the lean position. This should always be done with a gradual movement of the control.

(*b*) The fact that the control should be moved gradually from rich to lean does not imply, however, that it should be stopped a considerable distance before the point is reached to which it can be carried without a drop in speed. The control should always be moved to the limit consistent with maximum speed of the engine and regular operation.

(*c*) Under no circumstances must the control ever be set so lean that the engine back-fires, misses, or runs intermittently. With some special types of controls designed for very high altitudes, the control will stop the engine if moved too far to the lean position. This point very often comes at a surprisingly short distance after the point at which irregular operation first begins. It is, therefore, an additional reason why the control should be moved slowly and gradually when carried toward the lean position.

In view of the fact that some types of mixture controls are not very effective, neither a large drop in speed nor a marked change in operation will always be noticeable with the movement of such controls. The pilot should not jump to the conclusion, however, that the control is inoperative and that it is therefore unnecessary or useless to use it. As has been stated before, often when a control appears to be inoperative, a considerable saving in fuel is being effected without any exterior evidence as regards engine or aeroplane speed. It is, therefore, advisable always to operate with the control set as lean as possible, even though this may not cause a noticeable change in engine operation.

Important.—Before making a descent of any considerable distance, the control should always be moved to the full rich position.

In conclusion, the pilot is urged to use his control as much as possible, particularly where fuel saving is a feature, even though a little patience may be required to set the control for the best operation.

—*Air Service Information Circular.*

VELOCITY DETERMINATION IN McCOOK FIELD WIND TUNNEL

IN the records of tests made in the McCook Field wind tunnel it has been customary to give values of velocity in terms of "standard air"—that is to say, the velocity in a given test is such as will be produced on "standard air" by the pressure observed during the test.

"Standard air" is air at a temperature of 16° C. and a density of 0.0763, "G" being 32.2. This convention is proper because the density of the air cancels out when the air forces are computed in terms of the pressure causing flow, as shown below:

It might be desirable to explain how the lift coefficient is calculated, so that it will be apparent that the density does not enter into the calculation. Suppose that h represents the height of the water column corresponding to the velocity head at a velocity V; then if p/g represents the density of the air in slugs, $p/g \times v^2$ equals $K_1 h$. If p represents the lift on the model, and A its area, and K_y the absolute lift coefficient, then

$$P = K_y \frac{p}{g} AV^2, \text{ and } K_y = \frac{P}{\frac{pAV^2}{g}}$$

Substituting,

$$K_y = \frac{P}{AK_1 \times h}$$

It is evident that this last expression is independent of density, and as this equation is used in calculating the value of the lift coefficients in all cases, the density of the air in the tunnel does not affect the value of the lift coefficient.

Computation of velocity is as follows: For the graphs of this report, the usual wind-tunnel practice has been followed, where the density in the room rather than in the tunnel is used as a basis on which to figure velocity. This has been done for convenience in view of itself. The correction when applied does not change the value of the lift coefficient, but changes the corresponding value of the velocity.

The various charts reported in connection with the McCook Field wind-tunnel tests are then based upon values of the energy of the air stream rather than the actual velocity.

The determination of true velocity is dependent upon a knowledge of the temperature and density of the air flowing through the observation section. The temperature is calculated on the assumption that the expansion is adiabatic from the atmospheric pressure to the pressure corresponding to the dew point, and is polytropic below the latter pressure. A correct knowledge of throat temperature is, of course, essential; and it is necessary to develop a special method of thermometry for reading it. Present methods are inapplicable to its direct measurement, for a thermometer introduced into the air stream occasions more or less adiabatic compression of the air striking it, with consequent rise of temperature at the point of impact (see fig. 1). The most advantageous position for the thermometer is with the bulb downstream, where it is subject chiefly to skin friction rather than impact.

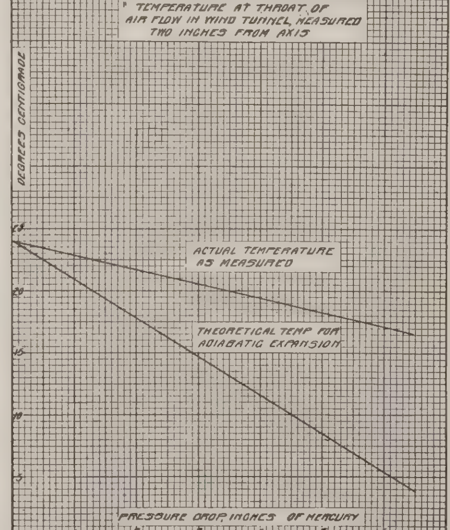


Fig. 1.

The assumption of adiabatic expansion in computing the temperature of the air is probably the best that can be made. We have no definite information as to the exponents in the case of assuming polytropic expansion. Liberation of heat of vaporization at the moment of condensation of the moisture contained in the air has a small theoretical effect on the thermodynamic action of the air. (For a treatment of the "Adiabatic changes of condition of moist air, and their determination by numerical and graphical methods" see "Smithsonian's Miscellaneous Collection," vol. 51, No. 4, 1910.)

As an example of the computation of actual velocity on the above assumption, refer to power run of March 7, 1919.

Barometer, 29.55" Hg.=2075/lbs./sq. ft.

Room temperature, 62° F.=521.6° absolute F.

Density, 0.0755 lbs./cu. ft.

Pressure in wind-tunnel throat, (—) 106.6 in. H_2O= 1,520 lbs./sq. ft.

Miles per Hour

Actual velocity........................525
Velocity in terms of standard air......465

DEFLECTION OF BEAMS OF NON-UNIFORM SECTION

THE purpose of this report is to explain and illustrate methods of calculating the deflection of beams of non-uniform section. The application of these methods to aeroplane analysis is given in article 173 of Structural Design and Analysis of Aeroplanes. All methods of computing the deflections of beams are based on the fundamental differential equation of the elastic curve of a beam under load:

$$\frac{d^2y}{dx^2}=\frac{M}{EI} \qquad (1)$$

Where—

x is measured along an axis tangent to the neutral axis of the beam,

y is measured along an axis perpendicular to the axis of x,

M is the bending moment acting on the beam,

E is the modulus of elasticity of the beam,

I is the moment of inertia of the beam.

The methods considered in this report are based on the special theorem developed from equation (1), that the deflection of any point in a beam, x, from a line tangent to the elastic curve of the beam at any point x_0, is equal to the moment of the area of the $\frac{M}{EI}$ curve of the beam between the two points, about x. The proof of equation (1) may be found on pages 130-134 of Boyd's Strength of Materials. The proof of the special case is on pages 153-156 of the same work.

The graphical and analytical methods shown in this report are logically identical, as both consist of computing the moment of portions of the $\frac{M}{EI}$ curve about points whose deflections are desired. It would be perfectly possible to make part of the computations analytically and a part graphically, and in some cases that is very desirable.

It should be thoroughly understood that the deflections obtained by these methods are deflections from a *tangent* to the elastic curve of the beam. This is not generally true of the deflection formulas found in the handbooks. The deflections found from the formulas are measured from a line passing through the supports, which line, in general, is not a tangent to the elastic curve. In such cases the deflection from the tangent must be modified in a manner to be explained in order to obtain the deflection from the line through the supports. In the case of a cantilever and of other beams so fixed that the elastic curve is horizontal over the supports no modification is necessary.

Graphical Method

The graphical method depends on the theorem generally used for finding graphically the moment of a number of coplanar forces about a point in that plane. The moment about any point of any number of coplaner forces is equal to the product of the intercept on a line through the point and parallel to the resultant of the forces, between the strings holding the resultant in equilibrium, the pole distance of the force polygon, and a factor depending on the scales of the force and funicular polygon (p. 343, Spofford's Theory of Structure). As all the forces in this work are vertical, the intercept in question will be on a vertical line through the point.

In order to illustrate the application of this method an example will be worked through. Assume a beam 210 inches long, supporting a load varying uniformly from 7 pounds per inch to 21 pounds per inch, as shown by the line *ab* in figure 1. Assume this beam to be supported 75 inches from the left end and at the right end. Assume the moment at the right-hand support to be zero. Assume the moment of inertia of the beam to vary as shown in figure 2.

The first step is to obtain the moment curve from the loading curve. To do this, divide the beam into any convenient number of sections. In this example the beam is divided into 14 sections, each 15 inches long. Any other number of sections could be used, and if desired they might be of unequal length. The reason for choosing 15 inches as the section length was that it gave a convenient number of sections and each section has a constant moment of inertia. Draw vertical lines through the centers of the sections. These lines will represent closely the lines of action of the resultant loads on each section. Draw the vertical line 0-14 in figure 3 and lay off on it 0-1, 1-2, 2-3, etc., proportional to the loads of sections 1, 2, 3, etc., in figure 1. Select any convenient pole distance, *P,* and draw the "rays" P-0, P-1, P-2, etc., completing the force polygon. Construct the funicular polygon, figue 4. From any point, *c,* on the line of action of force 1, draw "strings" parallel to P-0 and P-1 of figure 3. From the intersection of the string P1 parallel to ray P-1 and the line of action of force 2 draw a string P2 parallel to ray P-2. Continue until string P14 is drawn from the line of action of force 14 to the line of action of the right-hand reaction and parallel to ray P-14. Draw string PR from the intersection of P0 and the line of action of the left-hand reaction to the intersection of P0 and the line of action of the left-hand reaction to the intersection of P14 and the line of action of the right-hand reaction. Draw the ray P-R. In this discussion a ray is always a line in the force polygon, figure 3, and a string is a line in the funicular polygon, figure 4. Every string of the funicular polygon is parallel to the ray of force polygon with the same name. The magnitude of the left-hand reaction R_1 represented in figure 3 by R-0 and the right-hand reaction by 14-R. It is usually convenient to compute the values of R_1 and R_2 analytically as a check on the graphical work at this stage. In this case, taking moments about R_2,

$$R_1\times135=7\times210\times105+7\times210\times70= 7\times210\times175.$$

$$R_1=1{,}905.5 \text{ pounds.}$$

$$R_2=14\times210-1{,}905.5=1{,}034.5.$$

By scaling from figure 3—

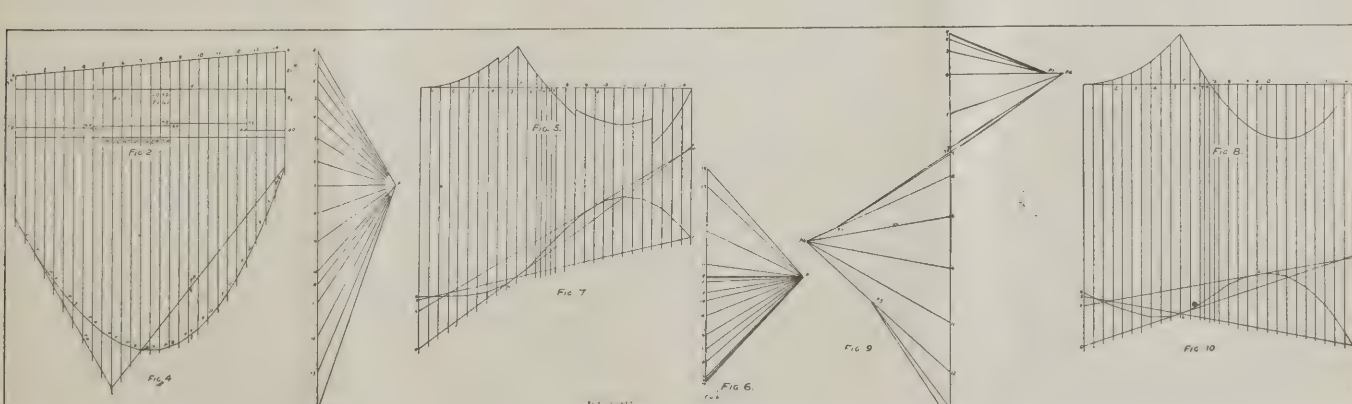
R_1=1,912 pounds.

R_2=1,028 pounds.

Error 6.5 pounds, or 1/50 inch.

This error is due in part at least to the fact that the line of action of the load on each section was assumed to be at the center of the section instead of slightly to the left of the center. This tends to make the value of R_1 too large. The funicular polygon of figure 4 is a bending moment diagram of the beam in figure 1 subjected to the 14 concentrated loads, one on each 15-inch section. It is evident that the bending moment curve for the uniform load is a curve inscribed in the polygon shown. The proof of this is as follows: Take the division point between any two sections, as point *d,* between sections 9 and 10. The forces to the right of *d* are 10, 11, 12, 13, 14, and R_2. They are represented in figure 3 by 9-14 and 14-R. This resultant is 9-R, which is held in equilibrium by the rays P-9 and P-R. In the funicular polygon *ef* is the intercept on a vertical line through *d,* between the strings P-9 and P-R, and is therefore a measure of the bending moment at *d.* In a similar manner the ordinate of the funicular polygon of figure 4 at any division point between sections can be shown to represent the bending moment at that point on the beam. It is therefore evident that if the divisions were made infinitesimal, the broken line P1-P2-P3, etc., would become a smooth curve inscribed in that line.

Figure 5 is the M/EI curve of the beam. The ordinates of this curve are the ordinates from figure 4 divided by a factor proportional to the moment of inertia at the same point, as shown in figure 2. The



ordinates from which the curve was plotted are those at the division points between the arbitrary sections into which the beam was divided for purposes of computation. The sudden breaks in the curve correspond to the sudden changes in the moment of inertia.

Figure 6 and figure 7 are developed from figure 5 in exactly the same manner that figure 3 and figure 4 were developed from figure 1. A smooth curve inscribed in the broken line *ghij* represents the elastic curve of the beam.

There are two modifications to this method which are illustrated in figures 8, 9, and 10. One of these modifications, shown in figure 9, is in the method of allowing for a change in sign of M/EI. In figure 6 areas 1 to *7a* are positive and are plotted from 0 down to *7a*. Areas *7b* to 14 are negative and are plotted from *7a* up to 14. All the rays are drawn from the same pole P. In figure 9 areas 1 to *7a* are also plotted downward from 0 to *7a* and rays are drawn from poles on the right-hand side of the line 0-14. The ray P_2–*7a* is prolonged to P_3, making P_2–*7a* equal to P_3–*7a*. The areas *7b* to 14 are also plotted downward, the rays being drawn from poles like P_3 on the left-hand side of 0-14. It is easily seen that a given ray has the same direction whichever way the force polygon is constructed. Suppose *7a–7b* in figure 9 had been laid off from *7a* up to *7b′*. To prove that P_2—*7b′* is parallel to P_3–*7b*. In the triangle P_2–*7a–7b′* and P_3–*7a–7b*, P_3–*7a* equals P_2–*7a*, *7a–7b* equals *7a–7b′*, and the angle P_3–*7a–7b* equals angle P_2–*7a–7b′*. Therefore P_3–*7b* and P_2–*7b′* are parallel, the alternate interior angles being equal, Q.E.D.

The second modification is in the method used to allow for the variation in I. In figure 5 the curve M/EI is plotted, while in figure 8 the curve of M is used. The ordinates of the curve of figure 8 are the same as those in figure 4. The only difference between figures 4 and 8 is that in the latter the base line is made horizontal for convenience. The areas of figure 8 are laid off as lengths in figure 9 exactly as figure 3 was constructed from figure 1. The pole distance, however, is varied in proportion to I. Thus the value of I for the first four sections of the beam is 50, so the rays P_1–0, P_1–1, P_1–2, P_1–3, and P_1–4 are drawn from a pole 50 units from the line 0-14. Between sections 4 and 5, I increases to 60, so the ray P_1–4 is extended to P_2, 60 units from 0-14 and the rays P_2–5 to P_3–8 are drawn from poles 60 units from 0–14. The pole was changed from P_2 on the right to P_3 on the left after drawing the ray P_2–*7a*–P_3 on account of the change in sign of M. In a similar manner the poles P_4 and P_5 are located 75 and 40 units, respectively, from 0–14 for the sections of the beam where the values of I are 75 and 40. The validity of the construction will be shown in the discussion of scales.

Proof

The proof that the curve *ghij* of figure 7 represents the elastic curve of the beam is as follows: Assume the number of sections into which the area of the M/EI curve, figure 5, is divided to be indefinitely increased. As the areas of the individual sections approach zero as a limit, the funicular polygon becomes a curve inscribed in the broken line *ghij*. Each tangent to this curve, as *klm*, will be the string of the funicular polygon between the lines of action of the differential areas of the M/EI curve on each side of the point of tangency and will be parallel to the rays of the force polygon holding in equilibrium the differential area at the point of tangency. In figure 7 as drawn with the beam divided into fourteen 15-inch sections, *klm* is the string between the lines of action of forces 9 and 10. These are not true forces as in figure 1, but rather areas of the M/EI curve called forces by analogy to the construction in figures 1 to 4. It is parallel to the ray P–9 of figure 6, which is determined by the total area of the M/EI curve up to the point *d*, figure 5, at the dividing line between sections 9 and 10. No matter how many sections the beam is divided into, the ray representing the total area up to any given point, such as *d*, will remain unchanged. The string *klm*, therefore, will continue to be the string from the line of action of the area to the left of *d*, to the area to the right of *d*, even when these areas are of differential size.

In figure 6 the area to the left of *d* is represented by 8–9 and is held in equilibrium by the rays P–8 and P–9. As this area approaches zero, the two rays holding it in equilibrium approach each other until they coincide. Thus the ray P–9 can be considered as two rays holding in equilibrium a differential force at 9, figure 6 representing a differential area at *d*, figure 5.

Consider any two tangents to the curve *ghij*, figure 7, as *klm* and *ohp*. These tangents are strings which hold in equilibrium the forces representing the area of the M/EI curve between *d* and *r*, figure 5. The intercept on any vertical line between the lines *klm* and *ohp* will be proportional to the moment of the area of the M/EI curve between *d* and *r*, about the point where the vertical in question intercepts the beam. The intercept on a vertical through one of the points of tangency will represent the moment of the area of the section of the M/EI curve about that end of the section. Whence, *in general*, the intercept of any vertical, between any tangent and the curve, represents the moment of the section of the M/EI curve between the point of tangency of the tangent and the vertical, about the point on the beam located by the vertical. Therefore, from the original treorem, the curve in figure 7 represents the elastic curve of the beam as the ordinate from any point on it to any tangent to it is proportional to the deflection of the point from that tangent.

In order to find the deflection from the tangent to the beam at any point it is necessary only to draw a tangent to the elastic curve in figure 7 at that point and multiply the ordinates from that tangent to the curve by the proper scale. The deflections from any other line can be similarly obtained by plotting the line in the proper position and measuring the ordinates from it to the curve. Thus, in a case similar to the one used for an example the deflection would probably be desired from a line passing through the two supports. The deflection will be proportional to the ordinates to the curve from a line, *shj*, drawn so as to intersect the curve at the points representing the supports. If the cantilever end were being considered by itself, the deflections would probably be desired from the line *ohp*, tangent to the elastic curve at the base of the cantilever. It should be remembered in plotting a reference line that a horizontal line will not in general appear on the funicular polygon as horizontal. Therefore, any reference line must be located by two known deflections or by the fact that it is tangent to the curve at a known point or the deflection at one point is known and also the fact that it is parallel to the tangent at some other point. This last case occurs in finding the deflection of an upper wing spar of an aeroplane like the Fokker D-7, where the deflections desired are those measured from a line cutting the curve at the cabane strut point and parallel to the tangent at the center line of the aeroplane. Fgures 8 and 10 are lettered in the same way as figures 5 and 7 and they may be referred to in the above proof with identical results.

Computation of Scales

One of the most important factors in the computation of deflections by this method is the computation of the correct scale. In figures 1 and 5, let 1 inch $= q$ inches for the linear scale. In figure 1, let 1 inch $= p$ pounds per inch run.

Then 1 square inch in figure $1 = pq$ pounds.

For figure 3, let 1 inch $= n$ square inch from figure 1.

Then in figure 3, 1 inch $= n.p.q$ pounds.

If the pole distance in figure 3 is h inches, the scale of ordinates in the bending moment polygon, figure 4, is 1 inch $= npq^2h$ inch-pounds.

If the ordinates of the moment polygon are now divided by the ordinates to the moment of inertia curve, and the quotients plotted to a scale of 1 inch $= m$ inch of modified bending moment ordinates, the scale for figure 5 is 1 inch $= mnpq^2h$ pounds per inches.[3] Therefore, 1 square inch of figure $5 = mnpq^3h$ pounds per inches.[2]

For figure 6, let 1 inch $= r$ square inch from figure $5 = rmnpq^3h$ pounds per inches.[2] If the pole distance in figure 6 is h_1 inches, the scale of ordinates for figure 7 is 1 inch $= rmnpq^4hh_1$ pounds per inch. For deflections this should be divided by E, so the scale of deflection will be 1 inch $= rmnpq^4hh_1/E$ inches. In the example computation in this report—

$r = 0.5$.
$m = 0.02$ the reciprocal of the value of I for which the ordinates of the curves of figures 4 and 5 are the same.
$n = 0.5$.
$p = 21$ pounds per inch.
$q = 30$ inches.
$h = 2$ inches.
$h_1 = 2.5$ inches.
Let $E = 1{,}600{,}000$.

The scale of deflections therefore is—

$$1 \text{ inch} = \frac{rmnpq^4hh_1}{E} = \frac{0.02 \times 0.5 \times 21 \times 30^4 \times 2.5}{1{,}600{,}000} = 0.266 \text{ inch.}$$

The ordinates of figure 8 are the same as those of figure 4, Therefore, 1 inch $= npq^2h$ inch-pounds and 1 square inch $= npq^3h$ pounds inches.[2]

Let 1 inch in figure 9 represent r square inch of figure 8. Then 1 inch $= rnpq^3h$ pounds inches.[2]

The pole distance in figure 9 varies as the moment of inertia and may be called kI.

The scale of deflection in figure 10 will then be—

$$1 \text{ inch} = \frac{kIrnpq^4h}{E} = \frac{krnpq^4h}{E} \text{ inches.}$$

In the present case the pole distance $= 0.05$ I. Therefore, $k = 0.05$. The scale of deflection is—

$$1 \text{ inch} = \frac{0.05 \times 0.5 \times 0.5 \times 21 \times 30^4 \times 2}{1{,}600{,}000} = 0.266 \text{ inch.}$$

The scale of figure 10 varies as the pole distance in figure 9, and the deflections represented in figure 10 vary inversely as the moment of inertia. Therefore, if the pole distance varies directly as the moment of inertia, the deflections will be represented in figure 10 to a constant scale.

Analytical Method

In the analytical method, the $\frac{M}{EI}$ curve is computed from the load curve and is in turn treated as a loading curve and moments are figured from it. In this method it is impossible to obtain the deflections from a line other than a tangent to the elastic curve directly. The deflections of the elastic curve and the desired base line must both be computed from a tangent and the results added or subtracted.

Either the $\frac{M}{EI}$ curve can be computed and further work based on it, or the $\frac{M}{I}$ curve can be used and the moments of it divided by the value of E as the last operation before getting the deflection. The latter method is usually preferable, as it gives more convenient figures to work with.

Moments are generally most easily obtained by the method of increments. This is based on the general formula

$$M_b = M_a + S_a X + P X_o$$

Where—

M_b is the moment at point *b*,
M_a is the moment at point *a*,
S_a is the shear at point *a*,
X is the distance from *a* to *b*,
P is the sum of the loads between *a* and *b*,
X_o is the distance from *b* to the resultant of the loads P.

The beam is divided into sections and the moment found at each division point between sections. The work can be most easily done if the work is done in tabular form. Table I shows the computations for the moment and $\frac{M}{I}$ of the same example as was used to illustrate the graphical method.

$$R_1 \times 135 = 7 \times 210 \times 105 + 7 \times 210 \times 70$$
$$= 7 \times 210 \times 175.$$
$$R_1 = \frac{1{,}470 \times 175}{135} = 1{,}905.5 \text{ pounds.}$$
$$R_2 = 1{,}034.5 \text{ pounds.}$$

Table I is aranged in the following form:

Column 1 is headed "Sta." and gives the distance from the left end of the beam.

Column 2 gives the loading in pounds per inch run at the corresponding stations.

Column 3 gives the sum of the adjacent figures in column 2.

Column 4 gives the distance between stations—in this example 15 inches in every case, but it is not at all necessary to have the stations equidistant.

Column 5 is one-half the product of the corresponding values in columns 3 and 4. It is the load in pounds carried by the section of the beam between adjacent stations. It is the quantity represented in the formula by P.

Column 6 gives the shear at each station and is the accumulated sum of the values in column 5. It is represented in the formula by S_a.

TABLE I.

Sta.	*w.*	Sum.	ΔL.	ΔS.	S.	ΔSX_0.	SΔL	M.	I.	M/I.
1	2	3	4	5	6	7	8	9	10	11
0	7.00				0			0	50	0
		15.00	15	112.5		825.0	0			
15	8.00				112.5			825.0	50	16.5
		17.00	15	127.5		937.5	1667.5			
30	9.00				240.0			3450.0	50	69.0
		19.00	15	142.5		1050.0	3600.0			
45	10.00				382.5			8100.0	50	162.0
		21.00	15	157.5		1162.5	5737.5			
60	11.00				540.0			15000.0	50 60	300.0 250.0
		23.00	15	172.5		1275.0	8100.0			
75 R_1	12.00			—1905.5	112.5 —1193.0			24375.0	60	406.25
		25.00	15	187.5		1387.5	—17895.0			
90	13.00				—1005.5			7867.5	60	131.125
		27.00	15	202.5		1500.0	—15082.5			
105	14.00				— 803.0			— 5715.0	60	— 95.25
		29.00	15	217.5		1612.5	—12045.0			
120	15.00				—585.5			—16147.5	60 75	—269.125 —215.3
		31.00	15	232.5		1725.0	—8782.5			
135	16.00				— 353.0			—23205.0	75	—309.4
		33.00	15	247.5		1837.5	—5295.0			
150	17.00				—105.5			—26662.5	75	—355.5
		35.00	15	262.5		1950.0	—1582.5			
165	18.00				157.0			—26295.0	75	—350.6
		37.00	15	277.5		2062.5	2355.0			
180	19.00				434.5			—21877.5	75 40	—291.7 —546.9375
		39.00	15	292.5		2175.0	6517.5			
195	20.00				727.0			—13185.0	40	—329.625
		41.00	15	307.5		2287.5	10905.0			
210	21.00				1034.5			7.5 error	40	0
						21787.5	21780.0			

TABLE II.

Sta.	M/I.	Sum.	ΔL.	ΔS.	S.	X_0.	ΔSX_0.	SΔL.	M.	δ_1	δ_2	δ_3
75	406.25				0		0	0	0	0	0	0
		537.37	15	4030.3		8.78						
90	131.12				4030.3		35,386	0	35,386	0.02211	0.07000	0.09211
		131.12	8.5	557.3		5.61						
98.5	0				4587.6		3,160	34,258	72,804	.04550	.10966	.15516
		– 95.25	6.5	– 309.5		2.16						
105	– 95.25				4278.1		– 668	29,819	101,955	.06372	.13999	.20371
		-364.37	15	-2732.8		6.30						
120	-269.12				1545.3		– 17,217	64,172	148,910	.09307	.20999	.30306
		-524.70	15	-3935.3		7.04						
135	-215.30 -309.40				– 2390.0		– 27,705	23,180	144,385	.09024	.27998	.37022
		-664.90	15	-4986.8		7.32						
150	-355.50				– 7376.8		– 36,503	– 35,850	72,032	.04502	.34998	.39500
		-706.10	15	-5295.7		7.49						
165	-350.60				-12672.5		– 39,665	-110,652	– 78,285	-.04893	.41997	.37104
		-642.30	15	-4817.3		7.73						
180	-291.70 -546.94				-17489.8		– 37,238	-190,088	-305,611	-.19101	.48997	.29896
		-876.56	15	-6574.2		8.26						
195	-329.62				-24064.0		– 54,302	-262,347	– 622,260	-.38891	.55996	.17105
		-329.62	15	-2472.1		10.00						
210	0				-26536.1		– 24,721	-360,960	-1007,941	-.62996	.62996	0
				-26536.1			-199,473	-808,468				

TABLE III.

Sta.	M/I.	Sum.	ΔL.	ΔS.	S.	X_0.	ΔSX_0.	SΔL.	M.	δ_1	δ_2	δ_3
75	406.25				0		0	0	0	0	0	0
		656.25	15	4921.9		8.10						
60	250.00				4921.9		39,867	0	39,867	0.02492	-0.07000	-0.04508
		462.00	15	3465.0		8.25						
45	300.00 162.00				8386.9		25,586	73,829	142,282	.08893	-.13999	-.05106
		231.00	15	1732.5		8.50						
30	69.00				10119.4		14,726	125,804	282,812	.17676	-.20999	-.03323
		85.50	15	641.2		9.05						
15	16.50				10760.6		5,803	151,791	440,406	.27525	-.27998	-.00473
		16.50	15	123.8		10.00						
0	0				10884.4		1,238	161,409	603,053	.37691	-.34998	.02693

Column 7 is the value of the section load from column 5 multiplied by the distance from the right-hand end of the section to the center of gravity of the load. Usually it is sufficiently accurate to assume the center of gravity at the center of the section, but in this case the true center of gravity was used. This is the quantity PX_o of the formula.

Column 8 gives the value S_a X, the product of the shear at one station by the distance to the next station.

Column 9 gives the moment at the various stations. It is the accumulated sum of columns 7 and 8.

Column 10 gives the values of the moment of inertia at the different stations.

Column 11 is the quotient of the values of column 9 divided by those in column 10.

This method of computing moments "by increments" is extremely useful where the load curve is irregular. It can usually be very easily checked. In this case it is evident that the moment at station 210, the right-hand reaction, is zero. The method of increments gives it, working from the left end, as +7.5 inch-pounds corresponding to an error of $7.5/135 =$ 0.55 pounds in the computation of the reactions, which is negligible. If desired the error can easily be distributed among the values for the moment at the other stations.

The size of section that should be used varies with the smoothness of the load curve, being relatively large for smooth

curves. It is advisable to have a division point at every point at which the moment may be desired in the further computation and every point where there is a concentrated load or a sharp break in the loading curve, or where the load curves passes through zero. There is no necessity of having the sections equal, though it is usually convenient in the computations.

In Tables II and III the column headed δ_1 gives the deflection from a tangent to the elastic curve at the left-hand reaction. The column headed δ_2 gives the vertical distance from the tangent at the left-hand reaction to a line through both supports. The column headed δ_3 gives the deflection from the line through the two supports.

Tables II and III give the computations for the elastic curve of the beam, Table II for the sections between the supports and Table III for the cantilever. In both cases the deflections are first computed for the tangent at the left-hand support station 75. This is given in column 11. Knowing the deflection of the right-hand support from the tangent it is a simple matter to compute the distance between the tangent and a line through the supports at any point. These values are given in column 12. Column 13 gives the deflection of the beam from the line joining the supports which is the algebraic sum of the values in columns 11 and 12. It should be noted that in Table II the sections are not all of the same length. The 15 inches between stations 90 and 105 was divided into two sections at station 98.5 because the values of M/L change sign at that point.

Table IV gives the values of the deflections from a line through the supports as obtained by the three methods used. The greatest divergence of the graphical method from the analytical is about 0.01 inch in a deflection of 0.40 inch or 2.5 per cent.

TABLE IV.—Comparisons of results deflections measured from a line through the supports.

Sta.	Analytical method.		Graphical methods.					
			Single pole.			Multiple pole.		
	Defl.	Defl./0.266	Defl.	Ord.	Error.	Defl.	Ord.	Error.
0	0.02693	0.101	0.02392	0.09	0.00301	0.02392	0.09	0.00301
15	— .00473	— .018	— .00532	— .02	— .00059	— .00797	— .03	— .00324
30	— .03323	— .125	— .03189	— .12	.00134	— .03455	— .13	— .00132
45	— .05106	— .192	— .05050	— .19	.00056	— .05316	— .20	— .00210
60	— .04508	— .169	— .04252	— .16	.00256	— .04518	— .17	— .00010
75	0	0	0	0	0	0	0	0
90	.09211	.346	.08871	.33	— .00340	.09037	.34	— .00174
105	.20371	.764	.19934	.75	— .00437	.19934	.75	— .00437
120	.30306	1.140	.29767	1.12	— .00539	.29502	1.11	— .00804
135	.37022	1.392	.36412	1.37	— .00610	.36146	1.36	— .00876
150	.39500	1.485	.38804	1.46	— .00696	.38538	1.45	— .00962
165	.37104	1.395	.36412	1.37	— .00692	.36146	1.36	— .00958
180	.29896	1.124	.29767	1.11	— .00129	.29236	1.10	— .00660
195	.17105	.643	.17010	.64	— .00095	.16744	.63	— .00361
210	0	0	0	0	0	0	0	0

The error is computed on the assumption that the analytical method gave the correct values.

Comparison of Methods

The accuracy and precision that can be obtained by the two methods are about equal. It is hard to say which method should be used in any particular case. That depends mainly on the personal equation of the computer. If he has only a 10-inch slide rule the graphical method will often be desirable when he might use the analytical method if he had a 20-inch rule or a calculating machine. A cantilever is easier to compute analytically than is a simply supported beam as the tangent at the support is usually the axis from which deflections are to be measured. In general, the analytical method is slower than the graphical but the latter requires much closer attention to the work as it is hard to construct the force polygon accurately and to draw lines exactly parallel. It is, therefore, hard to keep from making slips in the graphical method and there are not so many opportunities for checking the accuracy of the work as it proceeds.

Very often the computations for several beams can be combined. This happens more often when the graphical method is used than with the analytical. In designing internally braced wings for the Messenger aeroplane, the spars were of uniform cross section and the load on the front spar was a constant times the load on the rear, so one curve could be used for both spars. The scale of the loading curve differed for the two spars and the other scales varied in proportion. The lower wing spars had still different loadings, but they held a constant proportion to the loadings of the upper wing spars. The cantilever lengths differed for the two wings so one figure would not do for both wings, but the two figures could be drawn together with most of the work common to the two figures. By planning the work properly in such cases the labor required to find the deflections can often be very greatly reduced.

The following remarks are made regarding the two forms in which the graphical method is given. When the moment of inertia varies along a curve it is best to use the M/I curve and a constant pole distance changing the pole only when the values of M/I change sign. When the moment of inertia changes at only a few points and is constant between these points it is easier to use the M curve and pole distances proportional to the moment of inertia. There is less chance for error when the pole is changed from one side of the force polygon to the other to indicate a change of sign in the curve from which the force polygon is developed, but the construction requires more room.

New Type Propeller

An Englishman by the name of Bourke has invented a new type of propeller which it is claimed will go a long way in lessening the noise and vibration caused by the existing type of aeroplane propeller. It is claimed by the inventor that his propeller by attaining the maximum of thrust will increase speed and at the same time require less engine power. Instead of being smooth, the blades of the propeller have a number of flanges made of aluminum raised about six inches, which run in parallel lines across the surface and work just as the teeth of a turbine. With the new propeller the wash of the wind from the blades drives in a steady flow instead of striking the planes and struts in whirling gusts thereby increasing vibration. The grip of the serrated blades in the air is much greater, and therefore a much higher speed is obtained in taking off. It is understood that the Handley Page Company contemplate making exhaustive tests of the new invention in the near future.

Safety Precautions for Aeroplanes

According to a report issued by the Safety and Economy Committee of the Royal Aeronautical Society of England, which has made an exhaustive study of the subject of aeroplane accidents, it appears that the primary cause of breakdown is due to faults in the installation of engines and oil, water and petrol systems rather than to failure in the engine itself. Among the various suggestions for improvements, attention is drawn to the need of eliminating leakage of oil, which, it appears, is a serious matter, owing to the currents of air which are set up round the engine in flight. The committee recommends the development of pressure tanks for petrol storage in commercial aircraft, and calls attention to the importance of the use of a sound petrol gauge. It further recommends that rubber connections should be discarded in petrol pipes and that soft steel tubing be substituted.

With regard to engines, the committee urges more drastic tests than those at present made, reproducing as far as possible conditions met in actual use, and that aero engines be so constructed that they will "open out" to full throttle within a few minutes of starting, the practice of running an engine for a quarter of an hour or twenty minutes before opening up to full throttle being considered uneconomical. Evidence seemed to show that the practice was largely a matter of habit, and that the danger of "opening up" with the engine cold related chiefly to the oil gauges, an objection which could be overcome with suitable instrument devices.

Machines with a single central engine are given preference over those with power units installed in the wings, and the committee recommends a twin-engined aeroplane with two central propellers, one in front of the other. Power installation testing with a machine in flight is also suggested.

The committee urges that undercarriages should be readily detachable from the aeroplane, as under the present practice of building the undercarriage directly on to the aeroplane an accident to the former has meant an accident also to the latter.

NAVAL and MILITARY AERONAUTICS

Radio Controlled Auto at McCook Field

Recent visitors at McCook Field have been astonished at the gyrations of a brightly painted 3-wheeled vehicle which has been dashing to and fro between the buildings and among the airplanes on the field under no visible means of control. It is often seen to approach a group of persons blowing its horn wildly, and then when apparently about to strike them, to stop short with screeching brakes, back up with loudly clanging blow, make a sharp turn to the right or left, and to start off in the opposite direction. Great mystification has been shown as to the method of operation of this car, some visitors even wondering if perhaps a combination of the heat and newly made home brew may not have had a deleterious effect upon their observation powers. They are ofttimes considerably relieved to learn that the car is actually performing as they have seen it, though the mystery is lessened but slightly when they learn that the movements of the car are controlled entirely by radio impulses, which are sent out from the radio station at the opposite end of the flying field. The fact that there is no aerial or antenna system visible merely adds to the mystification.

The car is of cigar-shaped construction about 8 feet long, and runs on three pneumatic-tired wheels. It travels at speed ranging from 4 miles per hour to 10 miles per hour and the controls are so finely adjusted that it may be easily steered along a narrow roadway.

An examination of the interior of the car shows an amazing and confusing collection of batteries, switches, wires, vacuum tubes, potentiometers, relays, magnetos, etc., all of which are, of course, necessary to the complete control of the apparatus. The most interesting part of the apparatus is the "selector" which is in reality the heart of the entire control system. Various combinations of dots and dashes are sent out by means of a specially constructed transmitter, each combination calling for the accomplishment of a certain operation of the control apparatus. It is the function of this selector to "decode" these various combinations of dots and dashes which are sent out, and to close the circuits to the desired controls. So delicately is this selector constructed, and so rapidly will it operate, that it is possible to put into operation any one of 12 distinct controls in a period of less than one second. That is to say, less than one second elapses from the time any push button on the automatic transmitter at the distant radio station is pressed until the control on the car is in operation. Such speed of control has never before been accomplished. This car has been controlled equally well from an aeroplane and from a ground transmitting station.

The possibilities of radio control and its application to wartime problems are almost without number. Radio control can be applied to any mechanical apparatus that moves, whether it be in the air, on the ground, on the surface of the water, or beneath the water. Huge land tanks may be constructed and filled with T N T and driven to any desired point along the enemy's lines where the explosive can be fired by means of radio, or it can be applied in a similar manner to a boat, submarine, torpedo, or even an aeroplane and the explosive can be fired when and where desired. There is also an application in the commercial field, particularly in plants where long hauls between various parts of the factory are necessary.

Secretary of War and General Pershing Visit Langley Field

Secretary of War John W. Weeks and General Pershing, Chief of Staff, recently made the first general inspection of Langley Field since taking up their duties in the War Department.

After making an inspection of the field, which included the hundreds of planes, their crews and equipment, the party was given an exhibition of the planes in flight; pursuit, observation and combat formations being flown. A special demonstration of the efficiency of the new T. M. Scout plane was given by Lieut. Carl Cover, engineer officer of Langley Field. To an observer on the ground this little bird seems to climb a thousand feet as straight as an elevator and, apparently, with the same ease.

The distinguished visitors expressed themselves as greatly pleased with the work of Langley Field, much interest being shown in the enviable record of the aviators in the bombing project of the Provisional Air Brigade.

The Late Lieut. Willard S. Clark

Piloting one of the new Orenco scout planes, First Lieutenant Willard Shaw Clark, Air Service, was killed when his plane fell about 2,500 feet in a tail spin. The unfortunate accident happened at Ellington Field on June 19th.

Lieut. Clark specialized in night flying and was considered one of the most proficient night pilots and instructors in the Air Service. He participated in important searchlight tests conducted by the Air Service at Carlstrom Field in conjunction with the Corps of Engineers, and was highly praised for his meritorious work. Lieut. Clark was a native of Abingdon, Ill., and was 27 years of age. In August, 1917, he enlisted in the Aviation Section, Signal Enlisted Reserve Corps, as a private, first class, and was sent to the School of Military Aeronautics at the University of Illinois in November. He passed his R. M. A. test on May 8, 1918, and was commissioned a second lieutenant on June first following. After a little over two months' service at Love Field, Dallas, Texas, he was transferred to Payne Field, West Point, Miss., on July 24th, and the following month was sent to Carlstrom Field, Arcadia, Fla., for training as a pursuit pilot. Completing this course and also the aerial gunnery course at Dorr Field, he was assigned to duty as pilot instructor. On September 1, 1920, he was commissioned a second lieutenant in the Air Service, Regular Army, effective July 1, 1920, and was immediately thereafter promoted to first lieutenant. On May 9, 1921, he was relieved from duty at Carlstrom Field and ordered to Kelly Field, San Antonio, Texas, for duty with the First Pursuit Group.

Harding Nominates Moffet Rear-Admiral

President Harding has nominated Capt. W. A. Moffett as Chief of the Navy Department's Bureau of Aeronautics, with the rank of rear-admiral. Capt. Moffett has been interested in aviation for several years and is at present in charge of the naval aviation.

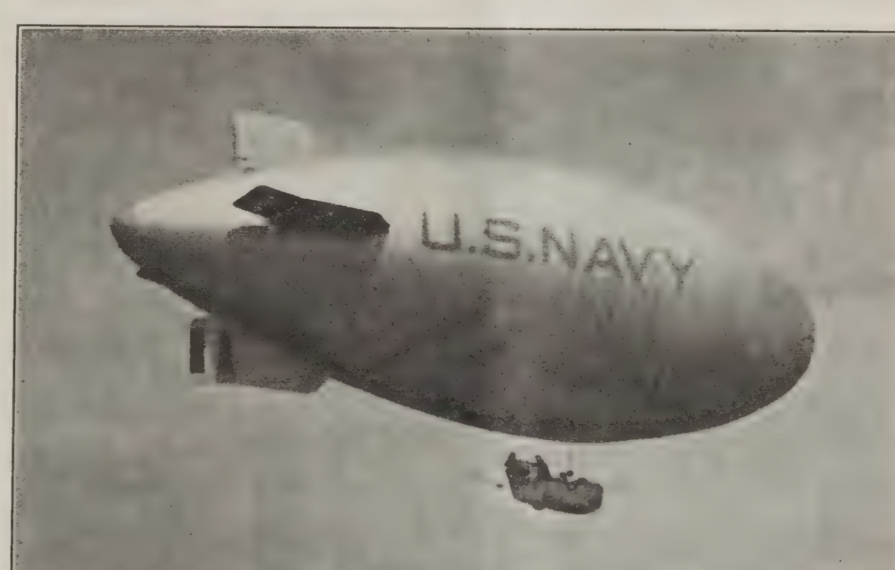


Photo by U. S. Naval Air Service

Towing airship H-1 being tested at Rockaway Naval Air Station. The ship is designed to fly to sea and by attachment to a cable on board ship it is used as a kite balloon for observation purposes. It is equipped with wireless telephone

FOREIGN NEWS

Stuttgart-Constance Air Mail Service

At the present time this service, which has been organized by Paul Strahle, an ex-war pilot, is being run by 3 Halberstadt C. L. IV machines, one of which has been adapted for passenger carrying. The time-table has been fixed to permit of mails being delivered on the same day by the ordinary postal deliveries and also to ensure further despatch by train the same day.

During March 8,000 km. were covered, and only 3 flights did not take place, owing to bad weather. In April, when the weather was much worse, 7,700 km. were flown in the course of 63 flights, of which 50 were mail flights. The journey from Stuttgart to Constance takes 55 minutes by air as compared with 7 hours by water or rail.

"Air Liner's" 10,000 Passengers

The Instone Vickers-Vimy "City of London" has now carried 10,600 passengers, and has done 360 hours' flying. Even giving the machine a full load on each flight, this only makes the average period of each flight about 20 minutes—a fact accounted for by the large amount of "joy-riding" work the machine has done.

Nile Valley Surveyed from the Air

Aerial surveys of the Nile Valley from the Delta Barrage to Aswan have, *The Times* reports, been completed by the Middle-East Air Force on behalf of the Egyptian Government. It is understood that the results of these surveys, which were executed both in high and low floods, are proving of the greatest use to the Irrigation and Survey Departments.

French Aeronautical High Council Created

In association with the French National Defence Council an Aeronautical *Conseil supérieur* has been appointed, and includes M. L. Eynac, the sous Secretary for the Air (President), General Buat, General Dumesnil, Maréchal Fayolle, General Benoist, etc. The Council will examine and report to National Defence Council upon matters and material concerning commercial aviation, watch the application of the aeronautical credits, for possible economies to be effected, generally put forward their views upon aeronautical problems, and make a study of the methods and propaganda of other countries.

The De Haviland Monoplane

We understand that the De Haviland monoplane is practically ready to fly. Its advent is eagerly looked forward to by the aeronautical world, as past experience has shown that De Haviland machines always show progress over their predecessors. In appearance the aeroplane is a large monoplane, not unlike the Fokker F3 which flies on the service from Croydon to Holland. It has cantilever planes with no bracing, and a very deep fuselage, whilst a Napier "Lion" engine provides the power. It is interesting to note that the Napier "Lion" appears to be becoming almost the standard engine for commercial aircraft—great compliment to a great engine.

Ices in the Air

Owing to the abnormal heat, which is unabated to any large extent at the ordinary flying altitudes, Handley Page Transport, Ltd., have introduced a free service of ices to the passengers flying on the London-Paris route. It is proposed to continue this practice as long as the heat wave lasts.

Prague Aerodrome Statistics for 1920

From January 1 to December 31, 1920, a total of 4,694 flights were carried out by 78 Service and 20 Civil pilots.

1,986 passengers took part in these flights. There were eleven accidents in which the machine was damaged, and only three cases—all military airmen—in which persons were injured; and this so slightly, that after medical attendance they were able to continue their work.

Thus there was one accident to every 426 flights and one case of injury to every 1,566 flights.

This percentage of accidents, which is, perhaps, high, may be ascribed to the fact that the first grade military school was transferred to the Prague Aerodrome during the year.

In the interest of foreign airmen who do not know the position of the Prague aerodrome, the Aviation Detachment has marked the centre of the aerodrome with a white circle 165 ft. in diameter with the word Prague in the circle, in letters 33 ft. high, direction N.—S.

The circle and letters are white sand, so that the name is legible from an altitude of 6.500 ft.

The ground is being lightly ploughed and rolled, and sown with grass.

International Air Station at Constance

A German aerodrome is about to be established on the German-Swiss frontier, to serve the purpose of an entrance station for Switzerland and international air traffic flying southwards. An inspection of the frontier district has already been carried out by a mixed Commission, formed of representatives of South Germany and Switzerland, Berlin experts on German aviation, and delegates from the Central Air Traffic Office. This commission was authorized at the same time to choose the most suitable place for an aerodrome, and Constance was decided upon. The town of Constance has already agreed to undertake all the necessary improvements.

Aircraft Prohibition in Germany

In consequence of the acceptance of the ultimatum, the German Government is now forced to accept the Entente's Boulogne Resolution of July 2, 1920, extending the prohibition against the construction and importation of aircraft. Consequently, when the Reichstag next meets, a new law will be issued further prohibiting the construction and importation of aircraft material. Thus export orders for aircraft material can no longer be considered. Instructions will be issued later with regard to the disposal of aircraft material constructed in the meantime.

Aviation in the Argentine

Aviation activity in the Argentine is increasing steadily, both in the capital and in the provinces. This country has received recently numerous shipments of flying machines, and is going to receive more. The new machines will develop school flying, and also be used in the organization of regular flights between the principal cities in the interior.

Here are the recent shipments and orders of aeroplanes for the Argentine:—

The military aviation school (Escuala militar de Aviación) of El Palomar has just received 15 machines, S.V.A. type, equipped with S.P.A. engines of 220 h.p., bought in Italy, and 20 'planes of the Avro type. These two types of machines are now used in this school, in which the total of the pupils is 40.

The Direction of Aeronautics (Dirección de Aeronautica) has received also, a short time ago, 36 Caudron aeroplanes obtained in Italy at reduced prices, and destined for civil aviation.

The director of the important aerodrome of San Isidro (north of the capital, on the River Plate) received in March, 1921, 14 Curtiss J.N. machines with engines of 90 h.p.; 4 of them were given to the military school, and the remainder are used now in the school managed by the director at San Isidro.

Handley Page received in April, 1921, 20 machines shipped in London, and comprising Bristol, Armstrong and Avro machines.

M. Guichard, a French captain, who was technical director of the French Argentine Air Transport Co., dissolved a few months ago, has bought in France 25 machines, of the types Spad-Herbemont, Potez and A. R. These 'planes were ordered for Argentine civil aviation firms.

The two British companies, The River Plate Aviation Co. and the Anglo-Argentine Aviation Co. (Compañia Anglo-Argentina de Aviación—recently organized), have recently received also important shipments during the last few months.

It is calculated that the number of flying machines bought since March, 1921, amounts to over 150.

This number is demonstrative of the progress realized by Argentina in aviation. The Argentine Republic is one of the leading countries of South America for aerial activities. It is one, too, where the future of aviation is the most promising.

Air Postal Stamps for China

In connection with the Peking-Shanghai air route, the Aeronautical Department is proposing to issue a new set of air postal stamps which will be sold for 15, 30, and 50 cents, respectively. The design of the stamps will be "an airship flying over the Great Wall." They will be inscribed in English and in Chinese "Air Post Service." These stamps will be on sale on the day that aeronautical traffic between Peking and Tientsin is inaugurated.

A "School" Fokker

We learn that a new Fokker mono. has been built for instructional work, and is fitted with a 90 h.p. O.X. Curtiss engine. Instructor and pupil sit side by side, and the machine is dual-controlled. The construction of *fuselage* and tail is in one unit of welded steel tubes.

A New French Air Paper

Les Ailes, a new French air journal, made its first appearance on June 23. The enthusiasm with which our Allies are taking up civil aviation is well shown by the number of air papers which are supported. *Les Ailes* will be concerned chiefly with aerial transport.

African Emir's Flight

The Emir of Katsena, accompanied by his son and staff, visited Kenley aerodrome last week. After a brief inspection of the station, workshops, and machines, the party witnessed some flying by officers of No. 24 Squadron. The Emir and his son and members of the staff were also given flights.

Aerial Motor Cycle

A Reuter's message states that an aerial motor cycle, invented by a graduate of Grenoble University, will shortly be tested in Paris. The inventor claims that he can utilize a propeller and wings attached to the framework to rise several metres and thus cross obstacles.

German Air Mails

The German daily press takes evident pleasure in recording the additions made during the last few months to the German air mail system. An especially gratifying development is the connection with the British air mail system, which, it is thought, will be particularly helpful in promoting foreign trade. In fact, the air mail schedule on the lines Hamburg-Bremen-Amsterdam and Berlin-Bremen has from July 8th on, been so arranged as to obtain an immediate connection with the Amsterdam-London afternoon service. Flights on the lines Hamburg-Rotterdam and Amsterdam-London will take place on weekdays, while the Berlin-Bremen service is done every day. There will thus on every day of the week be an air mail departure from Berlin, Hamburg and Bremen for the whole of England and overseas countries. All (ordinary and registered) correspondence will be admitted for conveyance between Germany and England, fees (in addition to ordinary postal fees) being the same as for transmission to Holland—viz., 40 pfennigs for postcards, 40 pfennigs (for each 20 grammes) for letters, 1 mark for each 50 grammes in the case of printed matter, samples, commercial papers. Air mail transmission for postal parcels is admissible between Germany and Holland.

New Australian Air Services

In addition to the air services to isolated districts in West Australia, it is stated that the Australian Government has decided to inaugurate services between Sydney and Adelaide and Sydney and Brisbane, and tenders have already been invited.

Berlin-Russia Air Service

A German aeroplane belonging to the Sablatnig Co. has arrived at Reval *en route* to Soviet Russia. It is proposed to establish an intermediate station at Reval when the prospective air service between Soviet Russia and Berlin has been established.

ELEMENTARY AERONAUTICS *and* MODEL NOTES

Models by "Aerial Age" Readers

ANOTHER enthusiastic reader of the Elementary Aeronautics Page and builder of successful duration models is Ernest A. Walen, of 254 North Grove St., East Orange, N. J. He has been a model enthusiast for the past ten years, formerly residing in Springfield, Mass., where he was a member of the Springfield Model Aero Club, and it is only recently that he resides near New York.

One of the model types designed by Mr. Walen is a single propeller pusher model, which is pictured below. In this model the rubber elastic is enclosed in the fuselage, so that the resistance of the rubber is lessened. The framework of the fuselage is 1/16-inch square wood, with diagonal braces of silk thread. The framework is entirely covered with rice paper and doped with banana oil. Wings are built up in the usual manner with bamboo ribs and pine beams. Covering is applied to the top surface only. The propeller is twelve inches in diameter.

Mr. Walen's particular interest is in distance and duration models and at present he is in possession of several of these types. Most of his flying consists of "solo" work, as he has not yet become acquainted with others in his vicinity whose interests coincide with his own. If there are any clubs or individuals in or near New York who are interested in arranging some distance or duration flights, Mr. Walen will be glad to have them communicate with him so that it will be possible for him to resume the pleasant and interesting associations always to be had when model fliers get together.

Ralph Rapien, of Norwood, Ohio, has completed a scale flying J.N.-4 model, which makes flights of 150 feet. It has a span of 36 inches and a chord of 4 inches. The propeller is 10 inches in diameter. The weight complete is 11 ounces. Some of its constructional features are: propeller hub-plate complete with bolts; wing panels connected with 5/16-inch steel bolts; struts attached to fittings by means of small bolts; shock absorbers provided for landing gear and tail skid.

One of the "A" frame racers built by Mr. Rapien has a 21-inch span, 4½-inch chord; front lifting plane 9 inches in span and 4½ inches in chord. For the motive power 70 feet of ⅛-inch flat rubber drives two 6-inch propellers. On this machine the wings were tested with the Glenn L. Martin No. 2 High Lift Section, which proved to have more than the average strength of structure. Tests showed the machine to be capable of high forward speed and rapid climb—but not suited for distance flights.

A 6-foot twin tractor monoplane, constructed to resemble a large bombing plane, has been designed and will be built by Mr. Rapien. The general dimensions of this plane are as follows:

Span	6 feet
Chord	9 inches
Overall length	54 inches
Overall height	14 inches
Wing Section	Martin No. 2
Weight (approximately)	25 ounces
Propellers (two)	10 inches

About 125 feet of ⅛-inch flat rubber will be used. The propellers rotate outwardly at the top and in opposite directions. The elastic strands run parallel to one another and attach to the stabilizer plane. Beyond the stabilizer is a one-piece elevator, adjustable from the front cockpit. The Loening type bracing is used for the wings in which is employed two diagonal struts on either side of the fuselage. Wings are set at two degrees incidence.

The fuselage has a maximum depth of 8 inches, is 3½ inches wide and 48 inches in length. Landing wheels are 4½ inches, carried on a ⅛-inch axle, 12 inches long.

Miscellaneous Notes

An aerial motorcycle, invented by a French University graduate, is to be tested soon in Paris. The inventor claims to be able to rise from the ground by means of a propeller and wings attached to the framework of the machine, to a height sufficient to clear fences and other obstacles near the ground.

Approximately 500 boys have been taken into the Royal Air Force as a result of examinations for boy mechanics held in Great Britain early this year. The successful candidates will be trained in various skilled trades in about the following proportions: 150 carpenters, 30 coppersmiths, 10 draftsmen, 300 fitters and 10 patternmakers.

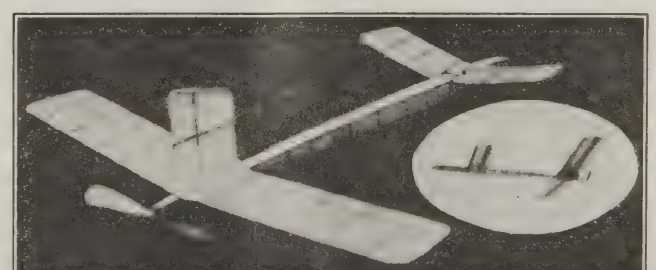
A preparation made for dissolving rubber was used in 1783 for preventing the escapement of gas from the envelopes of free balloons. It is said that this preparation has not been excelled for the purpose even at this late date.

Although German Aeronautic Societies are encouraging experimentation with small low-powered sport aeroplanes, the tendency of the British aeronautic press is to discourage attempts along this line. German aero enthusiasts are also turning their attention to gliders of original and elaborate construction, due, no doubt, to the regulations forbidding commercial aeroplane construction.

In designing propellers for models the following rules will be found to serve the purpose where extreme accuracy is not required. The diameter of the blades should be as large as consistently possible. This factor is usually determined by the ground clearance permissible by the design. The area of the blades should be approximately one-tenth of the area swept. The pitch should be about four-fifths of the diameter, depending principally upon the forward speed. The speed of rotation should be small, as this will conserve the power. As the speed of rotation is increased it is necessary to reduce the diameter. It will be found that the highest thrust will be obtained when the propeller has large diameter and slow speed.

Aeroplane Models to be Shown at International Aero Congress

It is reported that several of the finest model aeroplanes in the United States, most of them built by readers of the Elementary Aeronautics Page, will be exhibited at the International Aero Congress, which will be held in Omaha, Nebraska, November 3d, 4th and 5th. Negotiations are under way for the purchase of some of the striking models described in AERIAL AGE from time to time during the past six months. Mr. Earl W. Porter, president of the International Aero Congress, has taken considerable interest in some of the scale models pictured in AERIAL AGE, and it is expected that they will be arranged as a prominent attraction during the event.



A 90-seconds duration model built by Ernest A. Whalen. Insert shows the model in flight at an altitude of 50 feet

They All Flop Sooner or Later

Monte Rolfe

JOE BROWN and I.
WENT FOR a ride.
IN JOE'S Ford.
AND AFTER riding.
MANY MILES.
WE REACHED the field.
WHERE CRAZY men.
TEMPT PROVIDENCE.
BY GOING up.
IN AEROPLANES.
JOE SAID I'll fly.
IF YOU will too.
I SAID, "Poor Nut."
THE HEAT has made.
HIM LOSE his mind.
"FOR ALL the money.
IN THIS world.
IS NOT enough.
TO COMPENSATE.
ME FOR the risk."
BUT JOE was firm.
AND SO at last.
I WEAKENED.
AND WE flew.
WHEN WE got.
INTO THE plane.
I FELT.
HORRIBLY SCARED.
BUT WAS ashamed.
TO LET Joe know.
SO I said nothing.
BUT I felt.
VERY WEAK.
THE MOTOR started.
I FELT weaker.
WE LEFT the ground.
AND I felt weaker.
BUT WHAT is this.
I FEEL better
I ENJOY it.
IT IS beautiful.
IT IS wonderful.
I AM not weak.
ANY MORE.
I WANT to fly.
FOREVER.
BUT THE pilot.
HAS NO soul.
AND HAS stopped.
THE MOTOR.
AND WE are gliding.
SLOWLY DOWN.
WE HAVE landed.
AND NOW I want.
TO LEARN to fly.
AND BUY a plane.
AND FLY each day.
AND I want.
THE WORLD to know.
THAT FLYING is.
GREAT.

Color Not Important

We'd be a blonde, or deep brunette;
We really don't care which,
So long as we're not sick abed,
And reasonably rich.

—*American Legion Weekly.*

Lady Bountiful

Rounder: "I kissed Helen on the forehead."
Bounder: "And what did she do?"
Rounder: "She called me down."

—*American Legion Weekly.*

AWOL

The lovelorn swain, in days gone by,
"Oh, darling, fly with me!" would cry.
But now he whispers tenderly,
"Go absent without leave with me."

—*American Legion Weekly.*

"Do you smoke?"
"Yes."
"Well, here's a box to keep your matches in."

A Matter of Looks

A homely young English chap, having his view obstructed by the headgear in front of him, ventured to protest. "See here, miss," he said, leaning over, "I want to look as well as you."

"Oh, do yer?" she replied, with a rich Cockney accent. "Then you'd better run 'ome and change yer fice."

—*Boston Transcript.*

The Flight

By George J. Gould

Up above in the Heavens of blue,
Way up above where things are new,
Way up above where I'm nearer to you,
I am soaring.
Gliding along through the snowy cloud,
Gliding along where glory's shroud,
I am roaring,
Through azure seas.

The sun shining through way up above,
Shining through with that pure soul of love,
Onto my 'plane like a pure white dove,
I am dreaming.
Then as I fall,
I hear the birds that call,
My heart goes out, and gives them my all,
My heart is beaming,
For nature that flies.

Coming nearer the ground,
All safe and sound,
Crowds gather round,
"How was the flight?"
Asking me silly things.
Praises they start to sing,
Pilot of the wing.
All this world is bright,
Gay plane of Heaven.

I had an awful dream,
An' it seem
We went up for a jazz in the air,
And I was holding my sweetheart's hand,
While I was making a "land,"
With a BaCo ship
And we made some awful dips,
While I was kissing her lips
We spun, nose-dived and looped,
And then I awoke.

—*Rupe.*

Question: I made an aeroplane, and when I tried it out, it wants to fly on its back. What can I do?

Answer: Put the seat on top of the plane and change the wheels.

—*Rupe.*

Quite Natural

"Strange," murmured the magazine editor, "that this anecdote about Lincoln in his early days has never been in print before."

"It isn't strange at all," returned the contributor with some indignation. "I just thought it up last night."

—*American Legion Weekly.*

The Airman's Wish

By John W. Hiney

I'd like to go a flying
With a girl I know,
I'd like to take her with me
Where e'er I go.

I'd fly across the ocean
With her I'd land in France,
I'd have her sit beside me
If I only had the chance.

I'd make a trip to Egypt
The Pyramids to see
And I'd keep the plane fogging
If she'd only go with me.

I'd fly across the desert
Above the drifting sands,
I'd make a trip to Russia
Thru the Holy Lands.

I'd fly to Hawaii
Where we'd rest awhile;
Then to California
That beautiful sun kis'd clime.

There amid the roses
We would build our nest
And pass our days in happiness
In the golden west.

AERIAL AGE WEEKLY

VOL 13, No. 24 AUGUST 22, 1921 10 CENTS A COPY

Airscape of the Kensico Dam, Photographed for the Fairchild Aerial Camera Corp., by W. L. Hamilton

Aero Club of America Inaugurates National Membership Campaign

UBLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
ibscriptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIII NEW YORK, AUGUST 22, 1921. NO. 24

AERO CLUB OF AMERICA INAUGURATES NATIONAL MEMBERSHIP CAMPAIGN

THE Aero Club of America, which is the authoritative body representing national and international aeronautical affairs, has inaugurated a national membership campaign. Benedict Crowell is chairman of the membership committee, of which the other members are Howard E. Coffin, E. V. Rickenbacker, and P. J. Roosevelt.

The purposes of the Aero Club of America are directed to the advancement of all phases of aeronautics, including military and naval activities relating to national defense, the development of commercial aviation, the air mail service, the enactment of federal legislation governing aerial navigation, and the industrial and technical progress of the art and science of aeronautics.

As a non-partisan and constructive force for the national good, its influence is being extended to every state, every county, and every local community, and reorganization makes membership possible to all those everywhere, who are interested in aviation.

Through affiliation with the Federation Aeronautique Internationale, direct contact exists with the aircraft activities of all other countries of the world.

Members are kept in touch with world progress in aircraft, and the best organized thought of the country upon aeronautical issues will be transmitted to the legislative branches of state and federal government.

That our country may acquire and maintain leadership in this newest and fastest means of transportation, so intimately interwoven with all future plans for our national security and defense, is the desire of every American, and every reader of AERIAL AGE can render direct aid and support in this important end by putting the weight of their influence into the work through membership in the Aero Club of America.

Achievements of the Aero Club of America

The Aero Club of America is the mainspring of the aeronautic movement in this country, and before the war aviation received its chief support from this organization.

Long before America's entry into the conflict, when the United States Army and Navy had less than thirty aviators, the club undertook to train airmen and to form aerial reserves. Through these extraordinary and patriotic efforts over three hundred flyers were trained, many of whom joined the Lafayette Flying Corps while the others were commissioned in the Army and Naval Reserves authorized by Congress and organized by President Wilson upon the recommendation and as a result of the activity engendered by the Aero Club. These were the very first A. E. F. aviators to be sent overseas.

By means of energetic and well-directed national campaigns, the Aero Club of America was responsible for securing large appropriations for military and naval aeronautics, and urged the adoption of adequate plans for aerial preparedness.

Through the Club's offer to pay the salaries of flight surgeons, when there was absolutely no provision for same, the Medical Section of the U. S. Army Air Service was established, its services saving many hundreds of lives.

In Paris the Club organized a Foreign Service Committee, composed of prominent American members residing there, whose high standing in France and whose personal knowledge of the country enabled the committee to be of invaluable service and comfort to aviators, at the front and elsewhere.

As a result of the Club's strenuous fight, backed editorially by AERIAL AGE, and success in impressing Congress with the importance of encouraging this newest means of transportation, legislation to reduce the pay and rank of American aviators was defeated.

The Aero Club of America is the national organization, founded in 1905, and composed of clubs and individuals throughout the United States.

Some of its objects are:

To advance the development of the science of aeronautics.

To encourage aerial navigation, conferences, expositions, congresses, and contests.

To maintain headquarters wherever necessary for the accomplishment of the organization's purposes.

To cooperate with the Federal Government in whatever direction may be considered advisable and feasible to promote the advance of aerial development.

Invitation to Clubs to Affiliate

The following letter has been sent by Chairman Crowell to all aeronautic clubs and organizations throughout the country:

My Dear Mr. Secretary:

In the belief that aerial development urgently needs a National clearing house in Washington, D. C., the Aero Club of America has transferred its legislative and general membership departments to the National Capital.

Affiliated clubs never before have been asked to pay any membership fees, but it now becomes necessary to call for a nominal annual contribution to the work which must be carried forward if the United States is to keep pace with other countries in aerial development.

Your organization will be represented on the National Council, which will be called together periodically to discuss policies and methods for carrying out a definite program. Congress will not concern itself in aircraft progress unless convinced of a country-wide sentiment favorable to such an undertaking.

Timely bulletins will be sent to your organization, and in addition to the member on the National Council you will name representatives on several National committees entrusted with developing the plans outlined by the National Council and the Aero Club of America.

We hope your club will accept an affiliation with the Aero Club of America. With headquarters in New York and Washington we will be well-equipped to become most effective as the great National channel, enlisting the interest of all advocates of this newest transportation.

Very sincerely yours,

BENEDICT CROWELL, *Chairman.*
PHILIP J. ROOSEVELT,
E. V. RICKENBACKER,
H. F. COFFIN,
A. G. BATCHELDER,
Membership Committee.

Club Enrollment Form

The following form may be used by clubs that have not yet made application for affiliation:

To the Board of Governors:

GENTLEMEN: The undersigned aero club hereby makes formal application for affiliated club membership in the Aero Club of America, accompanying such application by a list of officers and membership list as of date.

This form of membership requires the payment of an annual fee based on the number of members:

Clubs having 100 members or less, $10.

Clubs having not more than 250 and not less than 100 members, $25.

Clubs having not more than 500 and not less than 250 members, $50.

Clubs having not more than 1,000 and not less than 500 members, $100.

Clubs having not more than 1,500 and not less than 1,000 members, $150.

Clubs having not more than 2,000 and not less than 1.500 members, $200.

Clubs having not more than 3,000 and not less than 2,000 members, $250.

Clubs having not more than 4,000 and not less than 3,000 members, $300.

Clubs having not more than 5,000 and not less than 4,000 members, $350.

Total Membership...... Name of Club..................
Amount Paid........... Secretary ....
Date .... Address ....

Officers of Club

President ....
First Vice-President ....
Second Vice-President ....
Treasurer ....

Representatives Council and Committees

National Council ....
Airports and Landing Places...............................
Foreign Relations ....
Contests ....
Legislation ....

The letter inviting individual membership is as follows:

My Dear Sir:

In the heart of every American I believe there rests the conviction that the future safety and welfare of our nation is vitually concerned in the proper and aggressive development of our air power.

Aerial transportation calls for governmental and public support, if America intends to keep pace with other countries in building up a commercial development that may be quickly converted into a means of national defense. Every day brings indication of the rapid strides of other countries in the advancement of aeronautics.

The activities of the Aero Club of America are being so reorganized and broadened as to make it more effective to serve as the great national channel for the clearance of aeronautic information, and through which may be expressed to our legislative and administrative bodies the best thought of the country on aircraft affairs.

Commercial aviation is the reservoir from which surplus craft and men would be available in time of stress. America should look ahead and encourage the new form of transportation, and we urgently desire your support in this movement, through membership in the reorganized Aero Club of America.

Will you not please fill out and return the enclosed membership blank with your check for the first year's dues?

Very sincerely yours,

BENEDICT CROWELL, *President.*

Application for Aero Club of America Membership (Metropolitan)

To Membership Committee of the Aero Club of America:

I desire to signify my interest in Aeronautics by applying for membership in the Aero Club of America through its New York City division, and I agree to abide by its rules and requirements. Remittance is enclosed to cover National and Metropolitan dues for one year from date, $30, plus 10 per cent tax, $3.

Signature ....

Address ....

Forward with remittance to Aero Club of America (Metropolitan Headquarters), 11 East 38th Street, New York City.

Application for Aero Club of America Membership (National)

To Membership Committee of the Aero Club of America:

I desire to signify my interest in Aeronautics by applying for membership in the Aero Club of America, and I agree to abide by its rules and requirements. Remittance is enclosed to cover National dues for one year from date, $110.

Signature ....

Address ....

Forward with remittance to Aero Club of America (National Headquarters), Mills Building, Washington, D. C.

Curbing Reckless Aviation

THE fine of $50 imposed in a Chelsea, Mass., court on an aviator for flying an aeroplane in such manner as to endanger life is of more than local importance. The defendant was charged with flying over a neighboring beach at an elevation of only 100 feet, and gave notice of an appeal from the decision.

Precedents in the legal regulation of aviation are so few that the progress of this case in the higher courts will be watched with interest. Flying is something new to the law and the disposition of flyers to take risks which endanger not only themselves but spectators appears to need the application of judicial restrictions. The practice of speeding aeroplanes over crowded grand stands or other public assemblages specially invites the attention of the law. The way to regulate is to regulate, and the attempt of a local court to curb aspects of flying which threaten public safety will be commended as a promising beginning.—(*Editorial in N. Y. World.*)

The News of the Week

Better Business Outlook For Aircraft Builders

New York—J. K. Robinson, Jr., President of the Manufacturers Aircraft Association, Inc., 501 Fifth Avenue, New York City, reporting on the condition of the aircraft industry, stated recently:

"The readjustment of the aircraft industry to a substantial basis, from which it can begin to build a solid and profitable commercial business, has been practicably accomplished. The achievement is regarded as unique and should provide considerable encouragement to long established lines in other fields of transportation which have been suffering from temporary depression.

"The aircraft industry is the newest activity bidding for recognition as a serious factor in modern business. It was nonexistent before the war. During the war it was expanded tremendously and when the war ended, it was left literally suspended with a capitalization of a hundred million dollars and a pay roll of several hundred thousand persons.

"Liquidation occupied 1919, the strictly war production firms going out of business. In 1920 the remnants of the legitimate aircraft industry encountered a season of extreme discouragement. Delay in recognition by the country of the potentialities of aircraft forced sharp contraction and the absence of any governmental policy of law or regulation made commercial aviation financially hazardous.

"This year, which has seemingly been marked by industrial depression generally, has witnessed an upturn in the aircraft industry. The fifteen or twenty manufacturing plants have been readjusted to a sound operating basis. Experimental engineering has greatly improved the usefulness and safety to aircraft. The thousand or twelve hundred aeroplane operators have definite assurance in the President's message, that, before many weeks, an aerial code will be passed, thus giving the entire art a legal status. With this constructive legislation actually in sight, the aircraft industry is making renewed efforts to exploit commercial aviation and there is gratifying indication that the public is ready to accept aircraft as an expeditious means of transport supplementing the railway, steamship and motor car, and that forestry, agriculture, mining, banking, photography, surveying, fishing, advertising, etc., will pay liberally for the improved and unique service which the commerical aeroplane offers."

Tests of the Remington-Burnelli Airliner

The test of the Remington-Burnelli Airliner to ascertain its aerodynamic efficiency and stability have developed very satisfactorily and are indicative of the considerable improvement in twin engine aeroplane performance. Up to August 12th the plane had made over forty test flights and had a total time in the air of twenty-one hours and reached an elevation of eight thousand feet, the longest single flight being two and one-half hours. The following expert test pilots have flown the plane to pass opinion on its conventional handling qualities, as well as their speculative elements, Bertrand V. Acosta, who conducted the initial test of the plane and flying it without and preliminary ground work; Lloyd Bertaud of the Ansaldo Company; Randolph Page, test pilot for the Aerial Mail, and Clarence B. Coombs, who is now conducting very exact performance tests. In view of the fact that this giant plane was designed for 550 horse power Packard motors, the flying qualities obtained through the use of direct Liberties which caused the plane to be about twenty-five per cent under power, is very promising and in fact, out of the ordinary. Now that the plane has proved its qualities in actual flight, beyond question, the installation of a permanent power plant will be affected. The unusual departure and speculation in the design of this plane recommended an extremely conservative policy in its testing. Therefore, cross-country trips and haphazard passenger flights have been discouraged. As soon as the final tests of this plane are completed and its new power plant installation thoroughly worked out, some record breaking cross-country flights can be expected, which will be to the good interest of commercial aviation. Too much significance and credit cannot be attached to this private aeronautical development as it has proved that the aeroplane is not restricted to a limited and impractical proportion of design that has heretofore been apparent. Rather the accommodation, comfort and accessibility, provided it be worked out in a correct engineering way, will greatly increase the performance and reliability of the future aeroplane.

Chicago-Twin Cities Air Mail

Lack of appropriation of funds by Congress has caused the suspension of the Chicago-Twin Cities route of the Air Mail, but only for the time being it is hoped.

Aero Club of Pennsylvania

At a recent meeting of the Aero Club of Pennsylvania D. J. Spence Jr. and A. Stanley Truscott were added to the Board of Directors.

Kokomo Aviation Meet

According to W. M. Fagley, secretary of the Curtiss-Indiana Company, the aviation meet which will be held at Kokomo, September 22-24, is an assured success. Great local enthusiasm has been aroused and a substantial list of contestants will compete.

Aerial Afternoon Teas

Afternoon Teas in Mid-air are the very latest hobby of Leon Errol. Having exhausted all the thrills of a daily indulgence in "Nineteen" holes of golf on every individual course within one hundred miles of his make-up mirror, and mastered the motoric mysteries of his new Six Cylinder Road Bus, the comedian-star of Ziegfield's "Sally" has permitted his well known sporting proclivities to back-slide to his realest love—aviation. Mrs. Leon Errol, who was the first woman ever to fly from Southampton to London—to and from a transatlantic liner—shares the aerial diversion of her hubby and lends an added air of social eclat to the air-tour by pouring tea for the guests who accompany them on their matinee cloud-spins, as they skim up and down the Harbor and around the Statue of Liberty for a breezy jaunt two afternoons a week.

A young nephew of the star Errols, recently returned from France; Mr. and Mrs. E. F. Flammer, Mrs. N. Holde and Mr. Phil Ruxton completed the party on yesterday's flight in the big Fokker cabin-de-luxe plane from Mitchel Field, Mineola.

The Alps By Aeroplane

Berne.—Trips to Alpine resorts by aeroplane are promised for next summer. The safe landing of the airman Durafour on the snow fields of the Dôme du Goûter, at a height of 14,210 feet, or 1,572 feet below the summit of Mont Blanc, is, according to the officials of a Swiss aeroplane company, only the beginning of a new era in Alpine tours.

The ordinary ascent of Mont Blanc from Chamonix takes sixteen hours, and the night must be spent at a height of 10,000 feet. The ascent from the hut must be begun not later than two hours after midnight, so that the ascent and descent can be made before the snow is much softened by the sun. By aeroplane tourists will be able to leave Chamonix about an hour and a half before sunrise and reach the Dôme du Goûter in about twenty minutes. Then, with a guide, they can reach the summit in another hour and watch the sunrise from the highest European mountain. Similarly, it will be possible to see the sunset from the summit.

Alpine aeroplanes will be stationed at all climbing centres, such as Zermatt, Arola, Grindelwald and Pontresina. Aeroplanes will be able to take passengers to the summits of certain mountains, for instance, from Zermatt to that of the Breithorn, which is 13,685 feet high, or from Zermatt to that of the Wellenkuppe, 12,830 feet high. But for mountains crowned with slender ridges of rock and snow or for rock peaks like the Matterhorn planes will land passengers on the snow plateau below the summit, whence they will be taken the rest of the way by guides.

The guides are alarmed at this prospect, but the aeroplane people say that more tourists will be ascending peaks for the sake of the view from the summits than ever ascended for the sake of climbing proper, and that the fees obtained for taking aerial passengers from the landing places to the actual summits will exceed those now earned from climbers.

Possible landing places in the high Alps are already being carefully examined by air pilots and mechanics, and planes will be specially constructed for landing on snow.

Each plane will carry six passengers and six guides and the passengers will be provided with the necessary equipment for the final ascent. The expense of an ordinary ascent, including that of spending the night in a hut, is hardly less than $40 for one person, and the cost of the plane trip is expected not to exceed $25 including pay for the services of a guide from the landing place to the summit.

Personal Par

Mr. and Mrs. Henry P. Davison have announced the engagement of their daughter, Alice T. Davison, to Artemus L. Gates, who won fame on the football field and the battlefield and now is seeking it in the field of finance, being connected with the New York Trust Company. Gates was in the Naval Air Service.

The AIRCRAFT TRADE REVIEW

Mayer Aircraft Corporation Active

The Mayer Aircraft Corp., of Bridgeville, Pa., has been doing good business for the last ten months. This corporation has the backing of C. P. Mayer, the Bridgeville sportsman, businessman, coal and oil magnate and air enthusiast.

The flying end of the business is in charge of three very efficient pilots, Lt. Robert E. Dake, Lt. Howard Blanchard and Lt. O. E. Schleifer.

The company has two landing fields equipped with modern hangars and complete supplies for Lairds, Orioles, Standards and JN4's are always available.

The company is now engaged in passenger carrying, advertising and photographic work and contemplates establishing an aerial transportation line between New York and Pittsburgh and Pittsburgh and Chicago in the very near future.

Atlantic City Fields

The Curtiss Aeroplane & Motor Corporation has two stations at Atlantic City, one, for hydroplanes, located at the inlet, at the extreme eastern end of the boardwalk, the other for landplanes, located about one-half mile inland, at the other end of the city, alongside the principal boulevard leading out of Atlantic City.

The water station, for hydroplanes, can be distinguished by the name on the roof of a large brick hangar. There are two hangars at the airport for landplanes. Supplies can be bought by wiring the Curtiss Flying Station.

New Baltimore Company

The American Aircraft Inc., of Baltimore, was recently organized for the purpose of manufacturing, assembling, and distributing standard and custom built planes, specializing in the "Canuck" and OX5 motors.

The company also maintains a department of operations embracing all the branches of commercial aviation, the department being in charge of experienced and competent pilots.

The aerodrome is situated at Logan Field, Md., five miles southeast of Baltimore. The plant and stores are situated at Dundalk, Md., a short distance from Logan Field.

All the personnel of the organization are among Maryland's pioneers in aviation. The officials of the company are Robert J. Stewart, president and treasurer; George O. Blome, secretary. The directors are F. G. Ericson, R. J. Stewart, G. O. Blome, W. H. Campbell, B. Gordon.

Ayars Returns to California

F. C. Ayars, who has been associated with Georges Voisin of Newark in aeroplane covering and repairing for some time is establishing an expert repairing and covering shop in the vicinity of Los Angeles, Cal., in the near future. Mr. Ayars is a charter member of the Aero Club of Southern California and is quite well known on both coasts, having been associated with the Interallied Aircraft Corp., Witteman-Lewis Aircraft and other manufacturers in similar work.

Curtiss Buffalo Field

The Curtiss Aeroplane & Motor Corporation Field at Buffalo is located 7 miles northeastward of the city and about 2 miles east of the large bend in the Niagara River northward of the city of Buffalo.

The field is easily distinguished from the air by a long scraped runway, but care must be taken in landing, as there are several cross ditches; these are, however, marked by red flags. The field has two hangars and is open from April 2 to December 1. Supplies and services are available.

Indianapolis Industrial Exposition

A number of aeronautic manufacturers will be represented at the Indianapolis Industrial Exposition to be held at the Indiana State Fair Grounds, October 10-15, under the auspices of the Indianapolis Chamber of Commerce.

UNITED STATES POST OFFICE DEPARTMENT—AIR MAIL SERVICE

Monthly Report of Operation and Maintenance, June, 1921

DIVISION	Gasoline	Grease and Oil	Repairs and Accessories	Miscellaneous	Motorcycles, Trucks	Rent, Light, Fuel, Power, Telephone and Water	Office Force and Watchmen	Warehouse	Pilots	Mechanics and Helpers	Radio	Departmental Overhead Charge	TOTAL	SERVICE AND UNIT COST: Gallons of Gasoline	Total Time Run	Total Miles Run	Cost per Hour	Cost per Mile
St. Louis-Twin Cities..	$3,592.65	$835.77	*$6,605.32	$1,114.50	$850.09	$215.60	$2,048.26	$866.32	$3,322.36	$4,109.30	$1,647.32	$624.81	$25,832.30	10,267	hr. min. 394 17	31,678	$65.52	$0.82
New York-Cleveland....	2,807.17	593.54	1,400.70	2,431.13	812.84	393.61	1,730.46	477.55	2,800.03	2,132.05	1,098.21	416.54	17,193.83	7,632	308 05	27,756	55.80	.62
Cleveland-Chicago.....	2,252.18	480.23	3,119.84	1,347.73	724.23	108.23	1,188.59	433.16	2,020.01	1,850.35	823.66	312.41	14,660.62	6,087	208 52	17,979	70.14	.82
Chicago-Omaha......	3,062.40	577.57	1,911.57	619.49	617.82	67.41	934.34	577.55	2,576.25	2,719.03	1,098.21	416.54	15,178.18	8,614	274 23	23,686	55.31	.64
Omaha-Salt Lake....	4,783.75	1,334.66	**7,111.25	1,649.25	577.44	194.75	1,863.40	1,203.22	4,486.66	3,785.95	2,287.95	867.79	30,146.27	15,220	556 33	48,324	54.16	.62
Salt Lake-San Francisco	3,125.93	722.98	†7,772.93	1,073.90	336.09	130.72	1,728.93	866.32	3,691.86	2,746.84	1,647.32	624.81	24,468.63	10,053	406 17	35,668	60.24	.69
Totals and Averages....	$19,624.08	$4,544.75	$27,921.81	$8,236.00	$3,918.51	$1,110.32	$9,493.98	$4,524.12	†† $18,897.17	$17,343.52	$8,602.67	$3,262.90	$127,479.83	57,873	2,148 27	185,091	$59.33	$0.69

* Includes new motor in plane No. 147.
** Includes cost of rebuilding plane No. 182.
† Includes new wings on plane No. 167.
†† Five days' additional pay to pilots on account of changing dates of making mileage payments.

Cost of dismantling College Park and Heller Fields, formerly on New York and Washington Division..................	$4,162.35
Loss on unrepairable crashes..................................	8,000.00
Total operating costs..................	$127,499.83
Grand Total..................................	$139,642.18

Overhead consists of: Departmental overhead; office force and watchmen; motor cycles and trucks; rent, light, fuel, power, telephone and water; radio.

Maintenance consists of: Miscellaneous; mechanics and helpers; repairs and accessories and warehouse.

Flying consists of: Gas; grease and oil; and pilots.

COST PER MILE

Division	Overhead	Flying	Maintenance
St. Louis-Twin Cities..................	$0.17	$0.24	$0.40
New York-Cleveland..................	.16	.22	.24
Cleveland-Chicago..................	.18	.26	.38
Chicago-Omaha..................	.13	.26	.25
Omaha-Salt Lake..................	.12	.22	.28
Salt Lake-San Francisco..............	.13	.21	.35
Entire Service..................	.15	.23	.31

E. H. SHAUGHNESSY, Second Assistant Postmaster General.

AERONAUTIC ROADS

By STORY B. LADD

THE growth of aviation will require the posting of the country, so that a flyer can lay his course direct for his objective point and can, en route, check and correct his course for air drift and verify his position. It is proposed to post the country on a block system which can be added to or differentiated as the growth of air travel requires, and whenever or wherever "road signs" are installed, whether under national or state auspices, by aero clubs, Chambers of Commerce, or other organizations, they will be in harmony with the general plan and become a part of the system.

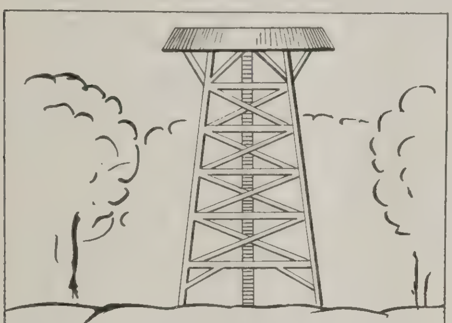
The country is to be laid out in 400-mile blocks, taking the 95th meridian and the 40th parallel as base lines. The 400-mile blocks will be subdivided into quarter sections of four 100-mile blocks, and the latter into 20-mile units. On the posted routes there will be elevated platforms at 20-mile block corners, showing from above a shape indicative of the 100-mile block and the quarter section, and a number identifying the 20-mile block unit.

All platforms in a 100-mile block will be of like shape or contour, with a short projecting arm indicating the quarter section, and will differ from those of adjoining blocks. The number shows in the center, placed to be read from the south, and will appear separate and detached from the surrounding platform, in the middle of an open central field. Four shapes will suffice,—circular, triangular, square, and trefoil.

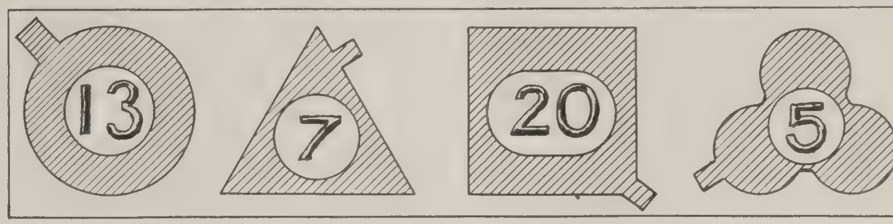
The platform structures will stand high enough to clear surrounding objects and in forest and timbered districts will show above the trees. In open country an elevation sufficient to be out of the way of cattle and drifting snows will suffice.

In the mountains or broken country, when the true location of a tower comes in a gorge, or where it would not be visible from a distance, it will be located at the nearest available point, the off-set showing on the map. The map can also show in forest and mountain districts, the direction and distance from a tower to the nearest open area available for an emergency landing, and the nearest town where oil can be obtained.

It will be necessary to preserve visibility when the ground and the platforms are covered with snow. For this purpose the platforms are made with a skirt around the edges, sloping outward at a steep angle, and painted black. From above this skirt will appear as a black line around the outer edge of the platform. Snow may adhere thereto to some extent on the windward side after a storm but sufficient portions will be exposed to catch the eye. To maintain the visibility of the numbers under snow conditions, they can

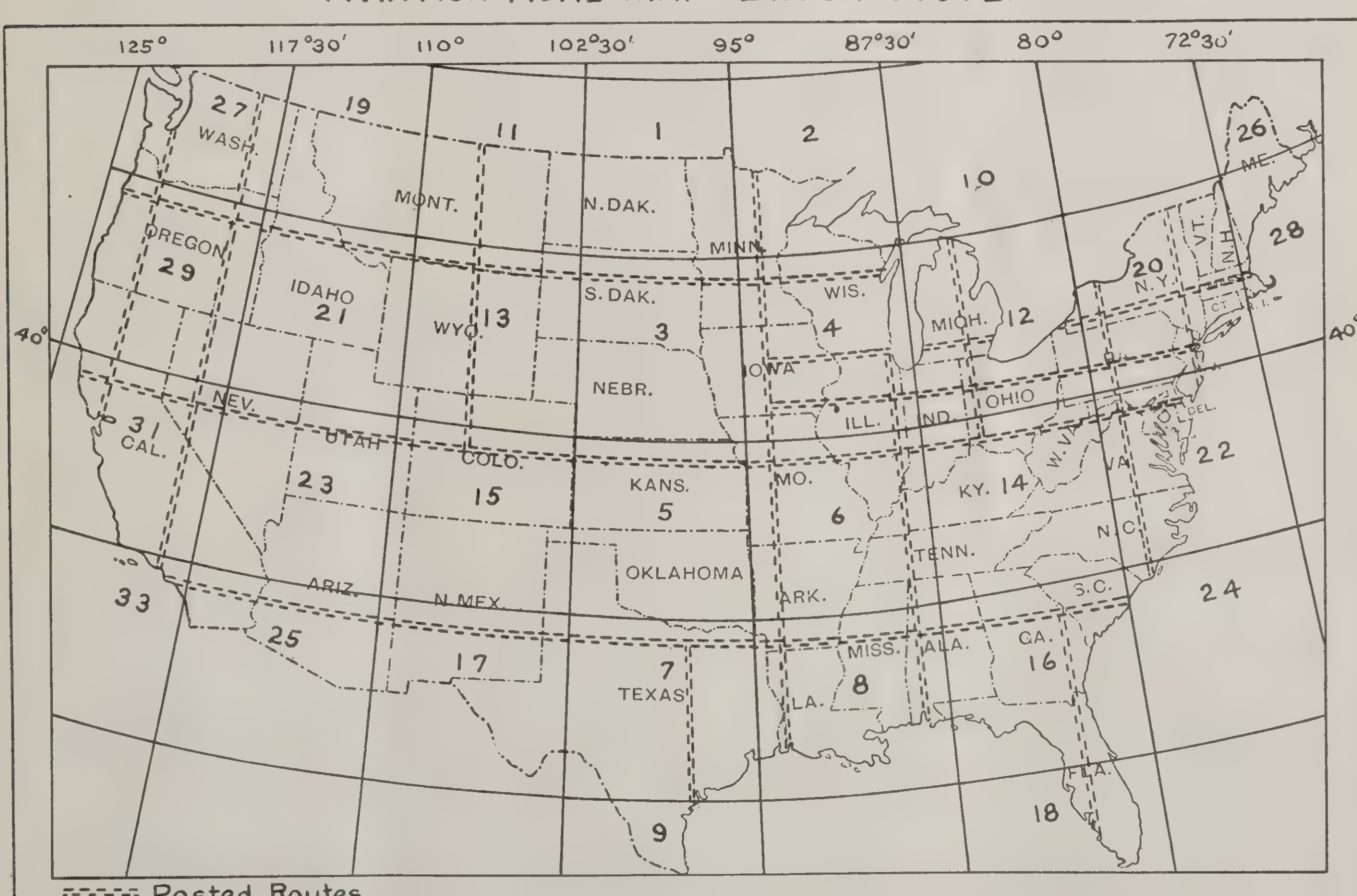


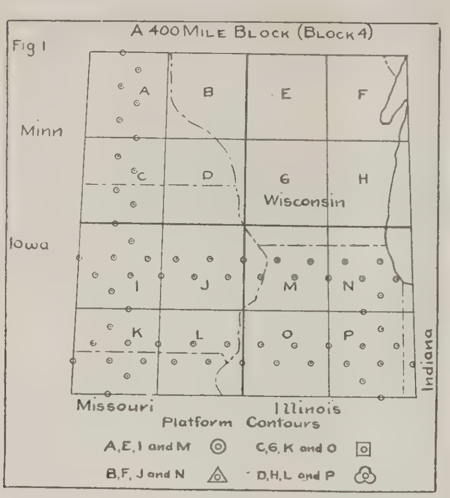
Marker platform



Circular, triangular, square and trefoil markers

AVIATION ROAD MAP—BLOCK SYSTEM





be made with hipped lines of steep slopes, and painted black.

Though in winter, in some districts, a platform may carry a heavy blanket, there will be open space around the number, and the lines will be sufficiently exposed to be decipherable.

The 400-mile blocks, the major units, are numbered for purposes of designation, from the 95th meridian, west and east, the odd numbers to the west and the even numbers to the east, beginning at the north and in consecutive columns. On the 40th parallel, seven and a half degrees of longitude is approximated, 400 miles (400.725 miles) and the meridians at 7.5° intervals, east and west from 95°, have been taken for the north and south lines of the major blocks, as per accompanying map. Though all north and south divisions will be distances of 20 miles or multiples thereof, the east and west divisions will vary with the latitude, being 20 miles or multiples thereof on the 40th parallel and ranging from approximately 17.7 miles at the Canadian border to 22.6 miles at the Gulf.

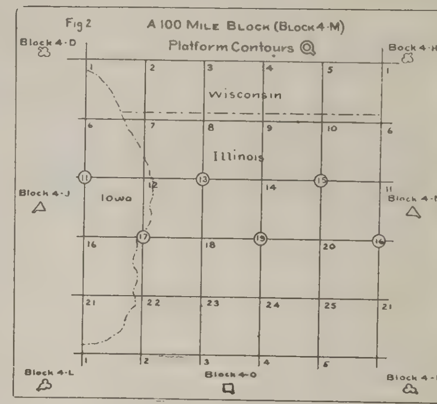
A major block comprises sixteen 100-mile units, lettered, for purposes of designation, A to P, beginning at the northwest corner and in quarter section groups (See Fig. 1). Thus, "16M" (the 100-mile unit M in block 16) indicates the 100-mile block in southeastern Georgia and northern Florida, and "27J" the Seattle block in Washington. In like manner, "31D" is the San Francisco block, and "20O," New York City and its environs.

The 100-mile units or blocks are subdivided into minor units, 20 miles square (except as to the variations due to latitude), numbered 1 to 25, beginning at the northwest corner of the 100-mile block. These are the tower or platform numbers. In designating the position of a tower, the number follows the block letter, and the major block number precedes it. Thus "20M 7" identifies a tower location (the tower may or may not be installed) contiguous to Albany, N. Y., and "15G 13" Denver, Colorado.

The accompanying map shows the major block system and indicates certain posted routes for purposes of illustration. Figure 1 is a diagram of Block 4, which covers portions of Minnesota, Iowa, Missouri, Wisconsin, Illinois and Indiana, and Figure 2 illustrates a 100-mile block (4M) in northwestern Illinois, with portions of Wisconsin and Iowa. The diagrams show alternate installations for the posted routes between two parallel lines, though it may be preferable to provide continuous postings on a single line.

A flyer may not be able to read the number from a considerable elevation, but if knowledge of the 100-mile block from the platform contour is not sufficient, he can descend low enough to decipher the number.

There is a possibility for duplicate markings in the major blocks, but any duplications will be 400 miles or more apart, and it is assumed a pilot will know his position within that range. Duplications with respect to contiguous blocks can, in the main, be avoided in laying out the posted lanes. Referring to the map, block 22 shows postings for north and south, and east and west routes, and towers alike in contour, quarter section designation, and number are possible for



blocks 22 and 20 and blocks 22 and 14. But a pilot would know his position as between North Carolina and Pennsylvania or as between northern Virginia or West Virginia and Indiana.

When traffic between two points becomes dense enough to warrant it, the direct route can be continuously posted by supplying the diagonal installations.

For night service on a route where there is regular travel, the platforms can be equipped with lights under radio control, so that an aircraft, with wireless control equipment, can, at will, cut in the lights within range. A view of the platform lights within range of control will enable the pilot to confirm his position and course, and lights will be on only as needed. With the posting of a comparatively few east and west, and north and south lanes, the country will be served. For example, for a trip from Chicago to El Paso, Texas, if the postings indicated on the map are installed, a flyer after leaving Chicago will sight "4M 13" and "4M 17" in eastern Illinois; then in northwestern Missouri he will cross the north and south and the transcontinental lane shown on the map near their junction point. There will then be no road sign until he strikes the southern transcontinental lane which he should cross, on a true course, at "17F."

PREVENTION OF FIRE BY SELF-SEALING TANKS

NUMEROUS attempts have been made to perfect a petrol tank which would be proof against leakage in the event of being punctured and proof against fire when pierced by incendiary bullets or other projectiles. Before such a device was perfected, approximately 75 per cent of the fatalities due to aircraft could be directly attributed to the fact that the fuel tanks were pierced, and the leaking petrol became a source of danger. Mr. Jack Imber, of London, England, undertook to study the requirements of a self-sealing tank, and his researches led to some remarkable discoveries.

A small bullet can inflict extensive damage when passing through a petrol tank. In many cases, it is found that an ordinary bullet will tear a hole six or eight inches in diameter in the side of the tank opposite to that through which the bullet enters. This phenomenon perplexed many inventors who were seeking to keep the petrol from leaking from bullet holes. Most of the devices failed, for either they were too heavy or some important detail of the structure was not properly disposed, because the actual forces existing in a tank under such circumstances were not understood.

Before giving a detailed description of the tank invented by Mr. Imber it may be well to present the theories upon which the invention is based.

A bullet entering a fuel tank makes an aperture of the diameter of the bullet itself. In emerging, however, a very much larger hole is torn in the metal.

Investigation showed that the larger hole was due to the enormous pressure of fuel against the far side of the tank.

On entering the tank the progress of the bullet is partly arrested by the liquid, and sets up in the liquid a pressure wave which increases both in area and force from the point of entry to a distance of approximately 2 ft. 6 in. Thus, when a bullet travels through a tank, its momentum is reduced; but, on the other hand, in a tank of ordinary size, it is found that up to a certain point the farther one side wall is from the other the larger will be the hole torn upon the exit of the bullet, because the pressure wave in the liquid is the main cause of the large hole torn at the exit.

It was seen that the pressure generated in the tank would either have to be confined or released. Many inventors sought to confine the pressure, but results showed that when the bullet made its exit the pressure sought release through the aperture made by the bullet, and in its effort to escape an enormuos rupture is made in the tank.

Having found the cause of the damage to a petrol tank when it is pierced, Mr. Imber was in a position to seek a means of protecting a tank to such a degree that not only would it prevent leaking when pierced, but it would also prevent the escape of the liquid in the event of a bad crash.

Tanks which had a small measure of success in stopping simple petrol leakages utterly failed to retain the liquid when the machine crashed. It is this latter feature which specially commends itself to the present designers of commercial aircraft, for it is well known that many crashes that in themselves do not result seriously are disastrous because the tank is unable to withstand the impact, and a fire follows.

The Imber principle is to allow the energy of the pressure wave to dissipate by providing the tank with a resilient outer rubber covering, so that when the pressure exceeds a certain point, the tank yields and the rubber stretches out from

the side of the tank under pressure. Naturally, the highest point on the stretched rubber covering is that through which the bullet makes its exit, and the rubber being stretched makes this point also the thinnest portion of the covering, so that when the bullet leaves, and the pressure is relieved, the rubber goes back to its former shape, and completely closes up and seals the bullet hole.

When the Imber tank first appeared, it was suggested by other experimenters that angular section braces for framework and diaphragm or baffle-plate supports should be used. Failures resulted, because when the metal brace was bent outwards against the covering, it required great pressure from the covering to force the frame back into place, and allow the rubber covering to assume its normal position. The aluminum tubing employed by Imber, after being bent outwards, is brought back into place with a great deal less pressure than that required to bend it in the first place.

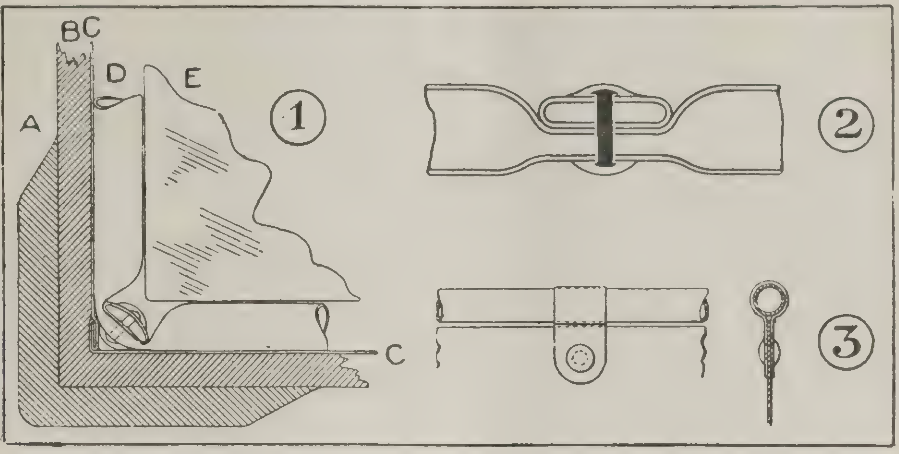
The elasticity of the rubber covering is sufficient to force the bent tubular members back, so that the bullet hole is closed; but, in cases where other inventors used angle frames, the rubber covering was torn by the unyielding metal.

The Imber tank is composed of three parts, which are shown in section in the sketch: The inside tubular aluminum framework to which sheet aluminum baffle-plates are attached. The framework is adapted to fit within and conform to the shape of the shell. The second part of the tank consists of a metal shell into which the baffle-plate frame is inserted. The third part of the tank consists of an outside rubber covering which surrounds the entire shell. The resilient or elastic covering returns to its seating against the framework in such a brief space of time that it is impossible for the contents to ignite in the event of the projectile being of an incendiary nature.

The tank is installed in the aeroplane by means of a cradle, in such a way that no rivets, bolts, etc., are used to secure it to the machine.

The general arrangement of the internal cradle or framework and baffle-plate is shown in one of our photographs. Of course, the principle is applicable to tanks of any shape or any size.

The framework is built up of aluminum tubing about $\frac{5}{16}$ in. in diameter, and 22 gauge in thickness. The diameter and gauge of material varies according to the size of the tank. Where the tube crosses one another they are held together by rivets as shown in Fig. 2, or they may be welded together. Baffle-plates are secured to the framework by means of aluminum clips as shown in Fig. 3. The entire framework, together with the baffle-plates, is constructed so that no rivets or other means are used to hold it in place in the shell. It is imperative that the inner cradle be not fixed in any way to the metal shell.



Some details of the Imber tank: 1. Section of a corner: A, rubber reinforcing; B, rubber covering; C, outer shell or casing; D, framework members; E, baffle plate. 2. Method of crossing the tubular members of the framework and of securing them with rivets. 3. The method of clipping the baffle plate to the inner framework of the tank

The function of the framework is to form a backing against which the rubber covering may seat itself to form a self-sealing covering.

The shell or casing is made of tinned steel. Other materials, including copper, were found to be inferior in some respects to the material finally adopted. Tanks with a capacity of more than 38 gallons are made of 28 gauge tinned steel. Joints are formed as indicated in Fig. 1. The joint is sweated, welded or otherwise formed without the necessity for the employment of rivets or other members passing through the metal.

The outer covering is of specially prepared rubber, which is put over the entire surface of the tank. The rubber is approximately ¼ in. in thickness. Edges of the tank are reinforced with an additional rubber strip ¼ in. thick, vulcanized to the covering rubber. The entire tank is then vulcanized for about 75 minutes under a steam pressure of about 40 lbs. per sq. in.

In order to provide for the greater security of the tank against leakage, all fittings are provided with double seatings, so that in the event of one joint giving away there will still be a second joint to prevent leakage.

In one convenient form of fitting the desired effect is obtained by having a flange internally threaded bush sweated upon the inside of the casing and surrounding the aperture for the fitting. Into this is screwed a second bush or sleeve carrying the fitting which makes the first-mentioned member a joint by means of fibre or packing. This second bush or sleeve projects beyond the rubber covering of the tank, and is surrounded by a metal washer which is forced into close contact with the exterior of such covering by means of a flange upon such sleeve so as to form a second joint or seating for the fitting. The inner bush is so constructed and arranged that it is practically flush with the inner surface of the metal shell.

No part of the fitting is allowed to project into the tank in a manner which would prevent the aluminum framework from being slipped into the tank.

Minor shocks are, of course, taken care of by the rubber covering, but when a hard blow is struck the internal construction gives. While the framework is strong enough to give adequate bracing to the tank under ordinary usages, it is purposely made collapsible upon the application of a blow likely to cause a puncture. In the case of a landing in which a smash occurs, the rubber covering retains the petrol, no matter how badly the tank may have been battered. While the framework of an aircraft may crumple and strike forcefully against the tank or the tank strike the ground, the result will merely be a distortion of the shape of the tank, thereby minimizing the danger of fire from the inflammable liquid that otherwise would have been sprayed about the wreckage.

OMAHA GETS PULITZER RACE

THE 1921 air race for the Pulitzer Trophy—the world's most important prize for speed in the upper realms—will be flown this year at Omaha, Neb., Nov. 3, under the auspices of the Aero Club of Omaha.

Announcement to this effect was made last night in the wideawake Nebraska city by Earl W. Porter, President of the club, and assurances were given that the 1921 contest will be conducted in a manner commensurate with the classic quality of the prize and the high standards established in the 1920 race, which was held last Thanksgiving Day with the starting and finishing point at Mitchel Field, Long Island.

Omaha will have to step along in lively fashion to equal the splendid arrangements which prevailed on that occasion—and the flyers will have to breeze through the air at terrific speed to equal the record established on that memorable day—but according to all reports received from the bustling Mid-Western city the circumstances surounding the second test of high-speed ships will equal, if not excel, the first.

Following is the official announcement of the race made last night at Omaha:

"The Pulitzer Trophy race will be the stellar attraction of the International Aero Congress, and the combination of the two events will make of the Omaha meeting the greatest aerial congress ever held in the United States. Forty-four of the world's best flyers were entered in last year's Pulitzer race and an equal or larger entrance list is anticipated for the Omaha race.

"The entire Executive Committee of the World's Board of Aeronautical Commissioners, consisting of a member from each of ninety-seven different countries, and the entire Executive Committee of the Aero Club of America will be at the meeting, according to President Porter.

"Capt. C. C. Mosley, winner of last year's Pulitzer race, will defend his title and cup, but whereas last year his plane traveled 132 miles in forty-four minutes and twenty-nine seconds, experts arranging for the coming race predict the winner must do better than 178 miles an hour to gain first place.

"One of the interesting entrants is a new type of biplane, which is to be en-

tered by the navy. The navy has not announced the speed this new ship has attained.

"The International Aero Congress, at which the Pulitzer race will be the chief event, has arranged for a national reunion of airmen, in which 10,000 former flyers are expected to take part. At the congress the airmen are expected to form a national organization similar to the American legion but to which only former flyers will be eligible.

"Another feature of the congress is an aerial exhibit to comprise every type of plane, balloon, blimp and other aircraft manufactured, including parachutes, bombs, guns, aerial cameras, mosaic maps, Government exhibits, and everything pertaining to the air.

"The air meet, for which $15,000 in prizes has been offered, will consist of derbies, sprints, climbs, stunts by balloons and planes and flying boat. The Tri-City Derby will include Omaha, Des Moines and Kansas City.

"An aerial pageant, written by Rupert Hughes and Eddie Deeds, will be one of the features. The pageant depicts the bombing of a French village by German planes and the conquering of the German aviators by American aces. Fifty-two American aces have accepted invitations to the congress and will take part in the pageant."

There was great rejoicing here in New York when word was received that the 1921 Pulitzer Trophy race would be held in such promising circumstances, and the following statement was issued by the Aero Club of America:

"The Contest Committee of the Aero Club of America states that the Pulitzer Trophy race, originally scheduled for Detroit, Sept. 10, will be held in Omaha, Nov. 3, 1921. The Detroit Aviation Society requested the Aero Club of America that they be permitted to postpone conducting this event until 1922 due to the failure of the Secretary of War to approve the appropriation recommended by Gen. Mitchell for Government participation in this event.

"The Aero Club of Omaha, having raised by public subscription sufficient funds to pay the expenses of Government and private participants, has made it possible for the Pulitzer Trophy Contest to be held this year. Their liberal contribution toward the advancement of American aeronautics is greatly appreciated by the Aero Club of America, the Air Services and all of those interested in aviation."

Solely the lack of funds prevented the Government from entering its army and navy racing ships. Both Secretary Weeks and Secretary Denby of the Navy expressed to Mr. Bragg and to various Detroit representatives, including H. E. Coffin, their deep personal interest in the race and extended to those visitors their best wishes for its success.

While Omaha gets the race this year, there is no doubt that Detroit will try to make it a still greater event in 1922.

PLANS OF THE AMERICAN AIRWAYS

A CONTRACT for the instruction of disabled war veterans in aeroplane mechanics has been awarded to the American Airways, Inc., of College Point, Long Island, by the Bureau of Vocational Training for Disabled War Veterans.

The American Airways, Inc., have prepared a plan of instruction which eclipses anything hitherto attempted outside of the Army and Navy Air Services, and it is so thoroughly broad in scope that the company is rendering a distinct service to the aeronautic industry because of the practical character of the work.

Major W. G. Schauffler, Jr., of the U. S. Army Reserve Corps, is president of the American Airways Inc., and is one of the most experienced pilots in the United States. He received his initial training at San Diego in 1915. In 1916 he joined the New Jersey Naval Reserve Aviation Corps and was acting Chief Petty Officer at the Naval Reserve Airdrome at Keyport, N. J. Early in the summer of 1916 he transferred to the Atlantic Coast Aeroautical Station at Newport News and completed his civilian flying training there, receiving experts' licence No. 72 of the Aero Club of America. In November, 1916, he enlisted at Fort Monroe and continued his flying training under army instruction, being commissioned a Lieutenant in the Signal Officers Reserve Corps and placed on active duty with the Third Aero Squadron on April 2nd, 1917, four days before the declaration of war with Germany.

He was transferred to the First Aero Squadron and landed in France with his unit September, 1917. In France he rendered distinguished service and was decorated by the French for galantry in action, and cited on numerous occasions. When he was honorably discharged in October, 1920, he was chief instructor Officers' Course at Langley Field.

Hugh D. McKay, Vice President of the company, was a lieutenant in the Canadian Flying Corps, and was an instructor at Leaside and Everman Field. Mr. McKay, prior to entering the service, was a newspaperman on the staffs of the New York Sun, Philadelphia Public Ledger, New York American, Los Angeles Examiner, and is now associated with one of the largest advertising agencies in New York as special counsel.

Captain T. L. Tibbs, chief instructor of the American Airways, is a Canadian by birth, but was educated in England. He rendered distinguished service in the Canadian Infantry, and in the Canadian Air Force. He commenced his commercial aviation with the Trans Oceanic Company. He subsequently joined the flying personnel of the Aeromarine West Indies Airways where he made a notable record for safety and reliability. He has a total of 1970 flying hours to his credit.

Captain G. W. Furlow, technical instructor, was a captain in the U. S. Air Service Reserve Corps. He saw service in France, participated in the Meuse-Argonne drive and was decorated with the D. S. C. and one oak leaf.

Captain Neil Murphy served with the Canadian forces and acted as adjutant and wing transport officer at Deseronto. He is a specialist in ignition.

Charles Richardson, who secured his technical education at Glasgow University, the leading educational institution in Scotland, is lecturer in wireless and military engineering.

Following is a resume of the American Airways course:

Preparatory General Course 8 Weeks

(a) Lectures on Commercial Aviation:
- History of Flight.
- Military Aviation During the War.
- Influence of War on Commercial flying.
- Recent Developments in Europe.
- Progress of Commercial Aviation in U. S.
- The Future of Commercial Aviation.
- Requirements of Commercial Flying.
- Type of Machines.

The establishment of the American Airways, Inc., at College Point, Long Island, with one of the company's boats in the foreground

Rules of the Air and International Agreements.
Landing Fields and Requirements.
Safety in the Air.
Commercial Aerial Photography.
Types of Aerial Cameras.
Theory of Flight.
Lighter-than-Air Craft.
History of the U. S. Air Mail Service
Equipment of an Aerodrome.
Organization of a Commercial Flying Co.
Equipment of a Flying Unit.

Demonstration Flight for All Students

(b) Practical Mathematics:
Fractions, Decimals and Percentage.
Measures of Extension, Capacity, Weight and Time.
Powers and Roots, Ratios, Proportions and Equations.
Lines, Angles, Polygons, Circles, Solids and Calculations.
Application of Logarithms, Curves, Plotting and Tables.

(c) Communications:
Semaphore.
Morse Code (Buzzing).
T Popham Panel.

(d) Seamanship:
Boathandling.
Knots and Bends and Heaving Lines.
Boatmanship.
First Aid.

Mechanics:

Engine Mechanics Electrical Course Blacksmithing Course	21 Weeks
Aeroplane Mechanics Instrument Course Boat Building Course	21 Weeks
(Preliminary	8 Weeks)
Total	50 Weeks

The above course of instruction applies to all students at the school. After completion of the above fifty weeks the student is a qualified commercial aeroplane mechanic and receives a general certificate. A specialists' course of nine weeks will be given in any one of the above subjects should it be desirable, in addition, to men specially qualified.

Specialists' Course—9 Weeks

Resume of General Course

Mechanics:

Engine Mechanics:
Applied Mechanics.
Overhaul, adjusting and repair.
Testing, cranking and trouble shooting.
Installation and testing.
Advanced Feld Training.
Bench Work (hand and machine).

Blacksmithing:
Forging and Welding.
Rough Tool Making.
Tempering and Annealing.

Course for Electricians:
Technical Electricity.
Instruments and Measurements.
Storage Battery.
Battery and Magneto Ignition.
Operation of Motors, Transformers and Generators.
Starting and Lighting System.
Telephony, Telegraphy and Radio.
Advanced Field Maintenance.

Aeroplane Mechanics:
Aeroplane Construction and Repair. (Woodwork; Metalwork; Wirework; Wing-Work; Fuselage Assembly and Alignment; Fabric Work—Work—doping and painting; Propeller Repair).
Assembly and Alignment.
Advanced Field Training.

Instruments:
General Practical Knowledge.
Installation, Adjustment, Maintenance and Repair.

Boat Building:
Joining and Cabinet Making.
Steam Box and Woodbending.
Caulking and Veneering.
Pontoon Making (metal and wood).

One week's practical demonstration and maintenance of machine away from her base.

Major W. G. Schauffler, Jr., President American Airways

Hugh D. McKay, Vice-president American Airways

T. L. Tibbs, Chief Instructor American Airways

A Plan to Reduce the Time and Cost of Air Seasoning Wood

In co-operation with the sawmills and wood utilization plants throughout the country, the Forest Products Laboratory, Madison, Wisconsin, is organizing an extensive field study on the air seasoning of wood. This study, it is believed, will be of extreme interest to the lumber manufacturer and to the wood-using industries. The purpose is to determine the piling practice which will result in the fastest drying rates consistent with the least depreciation of stock, the least amount of required yard space, and the least handling costs. The study will be carried on concurrently on both hardwoods and softwoods. All the important commercial woods of the United States will eventually receive consideration.

The air seasoning of wood is an old practice. No systematic attempt has ever been made, however, to work out the exact conditions under which drying time and drying costs can be reduced to a minimum. It is not actually known which of the numberless methods of piling will give the quickest and the cheapest results under given climatic conditions. The new project will furnish a comparison of the effects of such piling variables as sticker heights, the spacings of boards in layers, the heights of pile foundations, and the directions of piling with relation to prevailing winds and yard alleyways.

The study is expected to decide whether from a business standpoint lumber should be dried partly at the mill and partly at the plant of utilization, or whether it should be completely dried at the mill. The data collected will also go a long way toward showing whether air seasoning or kiln drying is the more profitable.

A tentative working plan of the air-seasoning study has been prepared by the Forest Products Laboratory, and copies are being sent to the secretaries of the various lumber and wood-using associations, state foresters, forest school heads, and others eminently qualified to comment on the plan.

Cooperation in the air seasoning study is being offered on every side. As yet the plants at which the work will actually be done have not been definitely chosen, but the extreme interest already manifested indicates that there will be no difficulty in securing cooperation with plants ideal for the study. Actual field work will soon be well under way.

DIRIGIBLES SUPERIOR FOR FOREST FIRE PREVENTION

Experiments in the use of dirigibles in the detection and control of forest fires and the patrol of National Forests in the vicinity of San Diego will be conducted some time this month. Plans are now under advisement, and it is probable that work will be started within a few days, according to a recent communication from Assistant District Forester R. L. Deering, of San Francisco. It is probable that dirigible B-3 will be used for this purpose. Secretary Henry C. Wallace, of the Department of Agriculture, in his request for co-operation of the Navy, said:

"Sir—The prompt detection of forest fires on the National Forests is one of the big problems of this department and in furtherance of efforts along this line advantage is taken of every possibility of value. The question as to practicability of dirigibles has been presented to me a good many times, but because of the absence of this special equipment and of funds within this department it has not been possible to act on the suggestion.

"I submit for your consideration the suggestion that you authorize the Commandant of the Naval Air Station at San Diego, Calif., to cooperate with the District Forester at San Francisco in experimental use of such equipment at his disposal as you might indicate to determine the practicability of dirigibles in the detection of fires and the patrol of National Forest areas.

"The opportunity for such experiments seems excellent in Southern California because of the existence of the Naval Air Station, extensive National Forest areas within reasonable distance, and the need for intensive patrol because of the prolonged dry season and fire hazard.

"Respectfully,
(Signed) "HENRY C. WALLACE,
"Secretary."

Secretary of the Navy Denby replied in the characteristic manner—by both letter and immediate action, and the Commandant of the 11th Naval District and the Commanding Officer of the Naval Air Station, San Diego, were directed to cooperate insofar as practicable with the District Forester at San Francisco in the experimental use of airships in the protection of forests and patrol of National Forest areas in the vicinity of San Diego, with the proviso that "the Navy's cooperation in this respect is dependent upon the location of the forests to be patrolled and the interference entailed with the operating program of the airships located at San Diego."

Assistant District Forester Deering is detailing some of his experts to assist in conducting the experiments, which, according to present plans, are to begin "some time early in August."

Local lighter-than-air officers are highly in favor of the practicability of using lighter-than-air craft in National Forest patrol.

Lieut. R. J. Miller, U. S. N., senior lighter-than-air officer, of the San Diego Naval Air Station, points to the dirigible's one great superiority over heavier-than-air craft (in its freedom from immediate forced landing in event of engine failure), as being in itself sufficient evidence of superiority for work of this nature.

"There is no doubt in my mind," said Lieut. Miller, "as to the successful outcome of any experiments in the use of dirigibles in the patrol of National Forests and the detection of forest fires.

"The advantages of dirigibles for this work are manifestly self-evident. First, take the matter of engine failure. The U. S. Army Air Service, in the conduct of its forest patrol, has already lost several lives and a very considerable number of aeroplanes as a result of forced landings in mountainous, timbered country, as a result of engine failure. This danger is practically eliminated with lighter-than-air craft. Engines do of course have their troubles in dirigibles, though not nearly as much as in heavier-than-air craft, due to the fact that they operate at much slower R.P.M., and the wearing stress and strain is reduced accordingly. But even granted complete engine failure, the dirigible pilot can 'free-balloon' his craft until repairs can be accomplished, or in event repairs are impossible, he can pilot his ship by air currents and the use of sand ballast and gas release valves to a point where safe landing could be made. Second, in the control of fires the dirigible could hover in the vicinity of such fires at a safe distance and a forest ranger-observer could direct his forces, either by dropping message bags, by radio in connection with portable ground outfits, or even by oral communication with megaphone."

FOREIGN TECHNICAL DIGEST

The New Henry Potez Aeroplanes

The Henry Potez, type VIIIR, is a sporting two-seater aeroplane, fitted with one Le Rhone engine developing 80 h.p. The seats are side by side, and the undercarriage, as shown in the photograph, is of unusual type.

Specification

Span	25 ft. 3 in.
Length	19 ft. 4 in.
Height	8 ft.
Total area	204 sq. ft.
Weight, empty	661 lb.
Useful load	507 lb.
Total weight	1,168 lb.
Duration	3 hours.

The Henry Potez, type IX, is a commercial plane for four passengers, with a water-cooled Lorraine-Dietriech engine of 370 h.p., with two Lamblin radiators mounted under the fuselage between the spares of the undercarriage. Aeroplanes of this type are used by the Compagnie Franco-Roumaine de Navigation Aérienne for the Paris-Strasbourg-Prague-Warsaw air line.

Specification

Span	42 ft. 7 in.
Length over-all	32 ft. 6 in.
Height	10 ft. 6 in.
Total area	474 sq. ft.
Weight, empty	2,435 lb.
Useful load	1,610 lb.
Total weight	4,045 lb.
Duration	5 hours.
Maximum speed	127 m.p.h.
Economical speed	111 m.p.h.

Aeronautics, July 21, 1921.

The Latham Flying-Boat

M. Latham recently built a commercial flying-boat that is a development of the naval flying-boats Latham used during the war. The engines are four Salmson engines of each 250 h.p. mounted in tandem in two "eggs." There are four airscrews, two tractor and two propeller. With full power the maximum speed is 101 m.p.h., and the range is 500 miles, endurance being 5 hours. Economical speed is 80 m.p.h., endurance being then 8 hours and radius of action 621 miles.

Following is the general specification of the last mode Latham flying-boat:

Span upper plane	104 ft.
Span lower plane	78 ft.
Total height	16 ft.
Total length	60 ft.
Total area	1,940 sq. ft.
Weight, empty	9,810 lb.
Useful load	6,060 lb.
Total weight	15,870 lb.
Total horse-power	1,000 h.p.
Load per sq. ft.	8 lb.
Load per h.p.	15 lb.
Horizontal speed at ground level	101 m.p.h.
Horizontal speed at 3,000 ft.	100 m.p.h.
Horizontal speed at 6,000 ft.	97 m.p.h.

Climbing speed, 3,000 ft. in 8 min.; 6,000 ft. in 19 min., 9,000 ft. in 30 min.—*Aeronautics, July* 28, 1921.

High-Altitude Meteorological Service by Wireless

Meteorological bulletins for aeronautical purposes, prepared by the High-Altitude Meteorological Department of the Prussian Aeronautical Observatory at Lindenberg, are now spread by wireless from the Königswusterhausen Radio Central Station by a 3,200-meter wave (undamped) at the following times: 6:50-7 a. m., 10:40-10:50 a. m., 5-5:10 p. m., 9:15-9:25 p. m. Each of these bulletins comprises: (1) A résume of high-altitude data as derived from pilot and captive-balloon ascents as well as aeroplane observations, and expressed in a special code; (2) a summary of barometer readings over the whole of Europe; (3) weather bulletins for Central Europe; (4) a prognosis for Central Europe, special regard being taken to the requirements of aeronautics.

NAVAL and MILITARY AERONAUTICS

Navy Bureau of Aeronautics Formed

Washington.—A general order formally establishing the Bureau of Aeronautics of the Navy Department was made public August 11 by Acting Secretary of the Navy Roosevelt.

While Rear Admiral W. A. Moffet is director of naval aviation, he served in the office of naval operations until the order was issued. Under the new arrangement all activities pertaining to naval aviation will center in the Bureau of Aeronautics.

Heretofore these activities have been scattered through several bureaus. The Bureau of Construction and Repair handled construction matters, the Bureau of Engineering looked after aviation engines, and various other bureaus had a hand in the flying activities of the navy.

In response to a strong plea by Secretary Denby, Admiral Moffet and others, Congress made provision in the Naval Apropriation Bill for the current fiscal year for the creation of a separate Bureau of Aeronautics, which is considered a very important change for the better by flying men and by naval officers in general.

The Bureau of Aeronautics will continue subordinate to the office of naval operations, but only in the sense by which other bureaus are subordinate to that office and the several branches of the army are subordinate to the General Staff.

Naval Constructors who have specialized on aviation will be transferred to the Bureau of Aeronautics and specialists in other bureaus who have been devoting their time and talents to flying likewise will be switched from their present bureaus to the new organization.

That much better opportunity for development and improvement will be possible with all air matters centered in a single bureau is conceded on all sides. Yet a good deal of pulling and hauling were required to get the authorization through Congress. While giving the navy a Bureau of Aeronautics, however, Congress actually reduced the appropriations for naval aviation below those of last year, which were insufficient. It is believed possible to make a better showing with the reduced appropriation under centralized control than if they were disbursed through several bureaus.

Maj. Fisher C. O. Airships

Major Fisher has been placed in command of the Lighter-Than-Air Section of Langley Field. Major Fisher relieves Major Paeglow, who returns to his former station as Commanding Officer of the Balloon School at Lee Hall, near Camp Eustis.

The North Island Controversy

So far, efforts to settle the question of joint ownership of North Island have been fruitless. A joint hearing of Secretaries Weeks and Denby has been arranged by the naval committee for last Monday, but, owing to the repeated demands from the House for the presence of members during the tariff debates, it was decided to postpone the hearing until after the tariff bill had been passed.

A bill, introduced by Representative Swing, was referred to the naval committee, to authorize the Secretary of the Navy to acquire 1,000 acres, more of less, at or near Camp Kearney, Calif., for a site for a lighter-than-air aviation station. It reads.

"That the Secretary of the Navy be, and he is hereby, authorized to acquire 1,000 acres, more or less, at or near Camp Kearney, Calif., for a site for a lighter-than-air aviation station, and to pay for the same an average price of not exceeding $100 per acre."

War College Remains at Newport

The proposition to move the Naval War College from Newport, R. I., to Washington, has been disapproved by Secretary of the Navy Denby. This action had been strongly urged by former Secretary Daniels. This action was taken principally for the reason that Mr. Denby was disinclined to incur expenditures by disturbing existing conditions. It is expected that the House Committee on Naval Affairs will allow the bill (H. R. 2491) to die in committee.

Roma Arrives at Norfolk

The long-looked-for "Roma" semi-rigid airship, purchased by the government for use of the Army Air Service, has at last arrived!

With the arrival of the big ship aboard the U. S. S. Mars Major Fisher, Commanding Officer of the Lighter-Than-Air Division, immediately left for Norfolk to make the necessary arrangements for the transfer of the ship to its home base, Langley Field.

It is planned to transport the various parts of the ship on barges across Hampton Roads to the Airship dock at Langley Field.

It is said that some time will be required in the work of assembling and setting up the mammoth dirigible.

Reductions in Personnel at San Diego

In accordance with general reorganization plans, the San Diego Station will, in the very near future, cease to exist as a Naval Air Station (insofar as flight operations are concerned), and become a repair and operating base for the Air Force of the Pacific Fleet. Though the change comes at a time of general curtailment of operations throughout the Navy, necessitated by reduced appropriations, the plan of reorganization is one that has long been under consideration.

The fleet air force is, and very evidently should be, the active center of all flight operations for Naval aviation. As the dreadnaughts, battleships, destroyers, et al., of Uncle Sam's surface fleets require home ports, Navy yards, repair bases, etc., so modern air fleets require adequate operating bases, repair bases etc., and the Naval Air Station at San Diego, with its steel and concrete buildings, modern ships and hangars, is surely the logical base for aircraft operations on the Pacific Coast.

Contrary to expressed belief of some of those who have helped make the Naval Air Station what it is today, operations will not be diminished—rather reorganized, systematized in line with new plans, and intensified. Station flying operations and the Station personnel engaged in the activities connected solely with flight will doubtless be transferred elsewhere. Work in the erection and test of both land and water planes (principally the former), and in the major overhaul of engines and aircraft of the Fleet Air Force will go merrily on. The development of the Station, be it called Air Station, repair base or what not, will continue as heretofore. Systematized, concentrated effort — efficiency! That is the watchword of the Navy today, and the present changes are in line with this policy.

Turn Indicator Being Used

Attention has recently been called to the value of the Turn Indicator for flying in bad weather, through the flight of Lieut. VanZandt of the Air Service from Moundsville, W. Va., to Washington in the fog in a DH-4B, and of Mr. Bruce Eytinge's flight from Philadelphia to Washington in a BaCo "Skylark" under similar conditions, both of which were described in Aerial Age.

These instruments have now been developed by the Pioneer Instrument Company to a point where they are available for commercial use, and may no longer be considered to be experimental.

Having completed a large quantity of Turn Indicators for the Navy Department, who adopted the Pioneer Turn Indicator after extensive tests on several different types, the Pioneer Company now has a stock of these instruments ready for immediate shipment on commercial orders.

Aircraft and Lightning

An experienced flier discusses the possibility of aeroplanes in flight being struck by lightning during a storm in a recent issue of *Illustrierte Flug-Welt.* His remarks are based on some 70 flights under such circumstances and on general principles. He shows that no danger is to be expected in the first place if the machine is not in the direct line of the discharge, and in the second place, even if it is, it is not likely from the nature and distribution of the conducting metal portion that danger due to fire will arise. Out of 30 cases where the machine was struck directly, the writer maintains that there were no evil effects, while in all known cases in Germany where a machine fell during a storm there was no evidence of scorching of parts or melting of metal.

FOREIGN NEWS

Stockholm-Reval Air Service

A new passenger and baggage air service has been opened between Stockholm and Reval. Machines leave Stockholm on Tuesdays and Fridays at 10.30 a.m. Swedish time, arriving Reval three hours later. The return journeys are made from Reval at 4 p.m. the same days. Passenger fares are 250 crowns Swedish, whilst baggage in excess of 15 kilos is charged at the rate of 5 crowns per kilo.

Argentine Height Record

A new height record was established in the Argentine on June 10 by the military pilot, Sargento primero Barrufaldi, a short time after the record of Pilot Olivero.

With a 300 h.p. Bristol machine Pilot Barrufaldi ascended up to 7,400 metres, carrying as passenger his mechanic, Luis Fossatti.

Acceleration of Morocco Service

The weekly air post from Toulouse to Casablanca (1,050 miles) will in future make the journey from France to Morocco in one day.

A trial trip of the accelerated service was made recently. The mail plane started from Toulouse, with bags which had just arrived from Paris, at 5 a.m., and after stopping at Barcelona, Alicante, Malaga and Rabat, reached Casablanca at 7 p.m. the same evening.

International Aviation Meet on Lake Garda for the Gabriele D'Annunzio Cup

The international aviation meet on Lake Garda for the Gabriele D'Annunzio cup will take place on Lake Garda during ten days of September, 1921, the date of beginning not yet announced.

Prizes to the amount of Lire 100,000 will be awarded.

(a) General Regulations.—The meet is reserved only for contestants belonging to allied or neutral countries. Contestants belonging to ex-enemy countries (late war, 1914-1918) will not be allowed to compete.

(b) The present regulations are drawn up and the competition will be carried out in accordance with the rules laid down in the "Regulations of the International Association of Motorboat Races" so far as the motor boats are concerned, and as prescribed by the "General Regulations of the International Aeronautic Federation" and by the "Italian National Aeronautic Federation" (Aero Club of Italy) so far as seaplanes are concerned (in this report the term "seaplane" includes flying boats).

(c) The contest will take place on Lake Garda in the month of September, the date of beginning to be announced later.

(d) The prizes are as follows:

I. Motorboat races, cash prizes amounting to Lire 50,000.

II. Seaplane races, cash prizes amounting to Lire 30,000, and the D'Annunzio cup valued at Lire 20,000.

Special Regulations governing the seaplane competition:

All contests for seaplanes will take place over circuits A, B, C and C bis, with the exception of any modifications specially mentioned hereafter:

Circuit A: Circuit of the South—Desenzano, Sirmione, Bardolino, San Vigilio, Maderno, Gardone Riviera, Salo, Isola, Desenzano. Departure and arrival at Desenzano; one lap, 50 km.

Circuit B: Circuit of the North—Riva, Gargano, Maderno, Gardone Riviera, Salo, Isola, San Vigilio, Torri, Malescine, Torbole, Riva. Departure and arrival at Riva; 1 lap, 100 km.

Circuit C: Circuit of the Lake—Gardone Riviera, Salo, Isola, Desenzano, Sirmione, Bardolino, San Vigilio, Torri, Malcesine, Torbole, Riva, Gargano, Maderno, Gardone Riviera. Departure and arrival at Gardone Riviera; one lap, 125 km.

Circuit C bis: Gardone Riviera, Salo, Isola, Desenzano, Sirione, Bardolino, San Vigilio, Isola, Salo, Gardone Riviera, Maderno-Toscolano, Malcesine, Riva, Gargano, Maderno, Gardone Riviera. Departure and arrival at Gardone Riviera; one lap, 150 k.m.

Qualifications and Entries: The definition of seaplanes as per the regulations of the Monaco Aviation Meet, April 13-30, 1921, has been adopted for the international aviation meet on Lake Garda. The types of seaplane which may enter the contest are as follows:

First Series—Weight-carrying seaplanes, Schneider cup type, 1920. Carrying 200 kg. of commercial load.

Second Series—Speed seaplanes, Monaco type, 1921. No commercial load.

Seaplanes will not be permitted to take part in any of the events of the program unless they have previously made a trial altitude flight in the presence of the Sporting Commissionaires of 3,000 meters in less than an hour for those of the first series (weight-carrying), and of 2,000 meters in less than 45 minutes for the second series (speed). These contests must be carried out on the first day of the meet.

Aviation Progress in the Republic of Honduras

Aviation is rapidly progressing in the Republic of Honduras. The Bristol machine that reached Honduras last April, the first aeroplane to fly in this country, has made many successful flights over and around the city of Tegucigalpa.

An aviation comittee has been created to interest prominent people in the formation of a corporation which will devote itself to commercial aviation between the capital and the interior cities. The whole country has answered the call, and it is expected that before the end of the year five or six machines will be brought over to be placed on a regular passenger and mail service, and also for the transport of small freight.

The Government has sent two young Honduraneans to the United States to study aviation. A flying academy is now in course of creation and will soon be opened and ready to start teaching all things pertaining to aeronautics.

It will be well to mention the great step given by the Minister of War and Navy, Dr. Carlos Lagos, towards the fostering of aviation in Honduras. On the 14th July Minister Lagos issued an order of the day suggesting that all officers and men of the Honduranean army and all persons connected directly or indirectly with the department of war and navy give one day's (the 14th of July) salary to the Aviation Committee as a contribution towards the purchase of several flying machines. The army answered with enthusiasm that all officers and men would gladly give their salary on that day to the Aviation Committee. This means many thousands of dollars towards the aviation fund.

Minister Lagos is a prominent lawyer and a General of the Honduranean army; he is also the brother of Mrs. Anita Lagos de Lopez Gutierrez, wife of the President of the Republic. General Lagos' influence is therefore most important and his assistance very valuable. He is a great believer in progress and thinks that aviation must be introduced in Honduras both for official and for commercial purposes.

The well-known review, "Renacimiento," one of the leading publications in Central America and the pioneer in aviation propaganda in Honduras, has been conducting a most enthusiastic campaign pro-aviation, and the results of its efforts are beginning to be felt in Honduras.

On the 15th September next,—Centenary of Central American Independence,—the aeroplane now in Government service in Honduras will make a flight over the whole Central American Isthmus, starting at San Jose, capital of Costa Rica, then calling at Managua, capital of Nicaragua, then San Salvador, capital of Salvador, Guatemala, capital of Guatemala, and ending at Tegucigalpa, capital of Honduras.

Aviation in South Africa

By Lieutenant-Colonel Vicomte Rene de Sarigny, O.B.E.

It is particularly unfortunate that in a country like South Africa, where distances are so great, railway transport so slow, climatic conditions so good and landing grounds so plentiful, that aeronautics have had little or no support.

The history of aviation in South Africa can be written in a very few words.

The pioneers of commercial flying were The South African Aerial Transport Company, Limited, and Handley Page (South Africa), Ltd.

Both these companies started operations with unsuitable machines, except for "joy riding." The Transport Company used Avros and Handley Page used their own heavy type twin engine busses.

Both companies went into liquidation during their first year of operations and ceased to exist.

Later there was started the Ross-Thompson Aviation Company, who operated all over the country, with headquarters in Johannesburg.

They have 110-h.p. Le Rhone Avros.

Captains Ross and Thompson—ex-officers of the Royal Air Force—are the proprietors.

In the Cape there is the Solomon Bros. Company. I believe they fly D.H.-6 type machines.

In Natal, Captain Mail is at work, also D.H.-6's and in the East London district Major Honnett operates with Avros.

All these gentlemen are well-known and keen aviators, who are doing great work in a small way—joy riding commercially—instilling into the public mind the safety of flying and wearing down the public prejudice against aviation. But there is no Government support for them and until a large company commences work on a business footing, using large machines capable of carrying about a dozen passengers, starting regular services at regular times at non-prohibitive fares, aviation in South Africa will remain backward. The pity of it.

The possibilities of a company succeeding are so great, yet the only thing that stops its progress is the usual want of capital. The enormous wealth of this country is in the hands of a few—very few. Mine magnates and commercial gentry will not invest in the air.

A "speculation" company open to public subscription becomes oversubscribed before the prospectus is out of the hands of the printers, whilst an aerial company does not raise sufficient interest to pay the printer for the prospectus.

Johannesburg (the hub of South Africa) to Capetown (the Parliamentary capital) is 1007 miles and takes 48 hours in an uncomfortable, narrow-gauged and unpunctual railway train. The same journey—but by air—could be done in a decent single-engined ten-seater machine in about 8 hours.

Johannesburg to Durban by train, 519 miles, takes 23 hours, and by air 3½ hours—and so on.

Recollecting the words of the late Jimmy Leonard, "There are more brains to the square inch in South Africa than in any part of the world,' one wonders how so great and famous and clever a barrister could be so mistaken.

And now the Government have inaugurated a Defence Air Force. But no subsidy for commercial flying.

Still there is a ray of hope.

An attempt is being made to float a company in London with a capital of £500,000. Its style is African Aerial Travel and Transport Company, Ltd. The board will be in London with an advisory board in South Africa, consisting of the writer hereof and other gentlemen.

The whole scheme has been carefully and well framed, provisional contracts entered into with all the leading merchants regarding the conveyance of parcels, and now is only waiting for the capital required to be subscribed before operations will be commenced and there is no doubt it will be a great dividend paying enterprise.

It is proposed to use Spad-40 machines, built by Messrs. Bleriot—the engine being the Napier Lion, 450-h.p. This type carries 10 passengers, pilot and mechanic, and has a cruising speed of 120 miles an hour.

Captain Victor Kelly is at present in England regarding the raising of the necessary capital, and during his absence arrangements are being made with the various municipalities to grant sites for aerodromes.

The Government has been approached with a view to their providing wireless receiving stations and each machine will be fitted with wireless telephony.

Messrs. Ashuret, Morris, Crisp & Co., the well-known London firm of solicitors are the representatives in England.

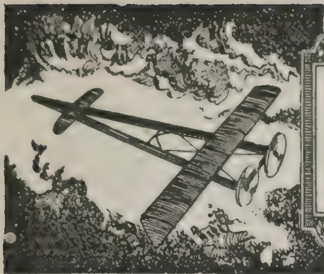
An interesting test was recently carried out in Johannesburg by the Ross-Thompson Aviation Company, Captain Ross flying an Avro using the new local invention, "Penrol."

This is alcohol treated with acetylene.

The test was eminently satisfactory, the engine starting first pull over of the prop. In the air the rev. counter maintained a steady 1100 revolutions and after flying for some time it was pointed out to the technical gentlemen present that the cylinders were extraordinarily cool, and the nose plate, which as a rule gets very hot when petrol is used, was hardly warm.

A company is at present being floated called Penrol (South Africa), Ltd., to place the new fuel on the market in this country, and it is the intention of the directors to register companies in various other countries at an early date.

The efficacy of the fuel has been proved beyond doubt by all the leading motor firms, and it will come as a God-send to aviation companies, as the petrol bill will be reduced by more than half.



ELEMENTARY AERONAUTICS *and* MODEL NOTES

Propeller Blade Outline

BLADE outline is the most conspicuous feature of a propeller, the thing which first attracts the attention of an observer —whether the blade is wide or narrow, straight or curved, square or round at the tip, etc. While this particular feature attracts the most attention it is actually one of the less important characteristics in the general run of designs. This is borne out by the fact that nearly every possible shape of blade has been made and used with more or less successful results. Only a relatively few designers can explain in what respects the blade shapes selected by them produce any different or better results from the forms chosen by other designers.

Were it not for the bending and twisting of the blade, one blade outline would be found to equal any other of the innumerable blade forms seen on various types of aircraft. When we take into account this bending and twisting, the necessity for carefully planning the outline so that it will bend or twist in a manner predetermined by its designer, is an obvious conclusion. Therefore if the designer desires that the blade shall be as rigid and unyielding as possible, he will select a form having the simplest and straightest lines, with practically constant increase in width and thickness from tip to hub. The designer will also avoid all decided curves or bends and all abrupt changes of form or dimension.

On the other hand, should the designer instead of endeavoring to eliminate all flexure or torsion of the blades, desire to take advantage of these tendencies, it is possible for him to lay out the blade with such a contour that the inevitable bending under thrust will be accompanied by a slight decrease of blade angle and a consequent reduction in pitch. This design then becomes a flexible and more or less variable pitch propeller in which the pitch changes with the twisting or torsional action of the blade under every change of pressure.

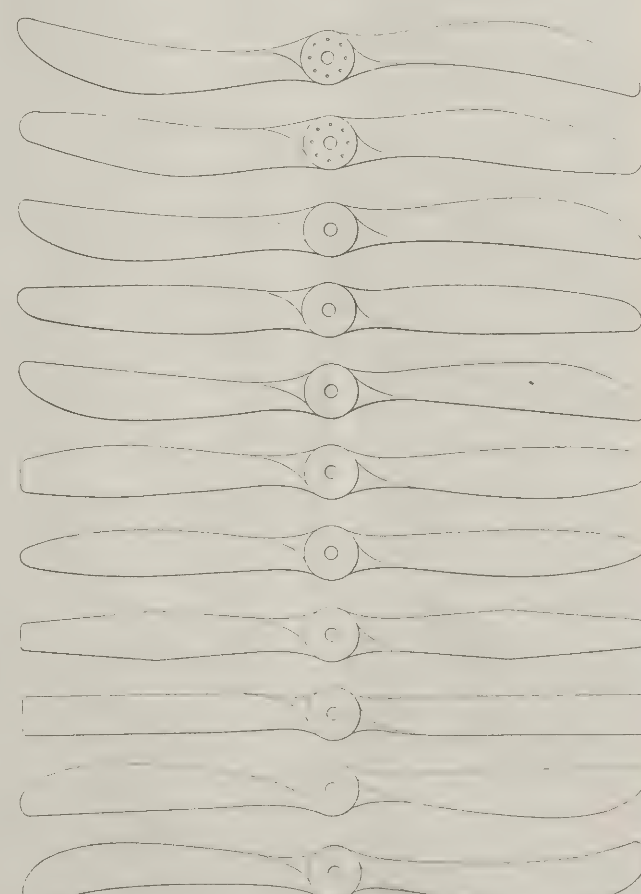
These two radically different types are shown among the outlines given below. The propeller at the top of the illustration is one of the Paragon designs, having torsional flexing blades. The outline below it is one used extensively by the Government during the war; it has the variable pitch feature to a certain degree. Third from the top, the design is, in a general way, similar to the first mentioned except that the blade is curved only so far as necessary to give stability of pitch and avoid all tendency to "flutter." Below it is shown the rigid type of propeller, possessing strength and stability—a straight, simple, clean design. Next is shown the type developed by the French designer Chauviere from whom it takes its name. It is also known as the "Integrale" from the trade name under which it was made. Sixth from the top, the blades with squared tips are frequently seen on European aeroplanes. The type below it, with evenly tapered blades, is one designed on the theory that the centers of gravity of the blade sections should be in a straight line. They were used on the Fokker planes.

One of the navy types is shown in the illustration fourth from the bottom; it has the merit of simplicity of form and convenience of manufacture. Below it is shown the "Normale" used by the French Regy brothers, and having a considerable vogue during the pre-war period. Next to the bottom we have a design which, in outline, is almost the exact reverse from the third one on the list. It has been used a great deal in Europe, but to only a limited extent in the United States. The blade outline at the bottom of the illustration is one of a rather unstable type but which can be successfully used where the engine power is low or where the blade is of exceedingly rugged construction for the duty it must perform.

Rigid types have their best application in connection with craft or machines in which there is continuous heavy duty nearly constant in character, as on heavy seaplanes, dirigibles, etc. The flexible variable pitch propellers have their most efficient application on the relatively small and higher speed machines, such as speed scouts, machines for trick and acrobatic stunting, scout seaplanes designed to fly from the decks of ships, etc. Their employment is desirable whenever there are wide variations in the speed and head-resistance of the machine and where very high initial thrust, as compared with the normal flying thrust, is an essential requirement.

Flexing propellers are designed on the principle that the blade should constantly bend and that the bending of the blade should be accompanied by a torsional or twisting action by which the pitch would automatically change to accommodate the propeller to favorable action with every change or fluctuation of conditions affecting it. In plan view the blade retreats toward the trailing edges in a continuous curve from hub to tip. With this shape of blade the centers of pressure of the sections lie about one-third the blade width from the leading edge. From this positioning of the centers of pressure comes the result that any increase of pressure on the blade causes it to flatten out and reduce its pitch momentarily or during continuance of the increased pressure. Similarly, any decrease of pressure permits the blade to twist in the opposite direction and increase the pitch.

As the thrust on a propeller is at all times equal to and opposite the head-resistance of the aeroplane, there are necessarily great variations of pressure on the propeller under the different conditions of flying, such as in starting, climbing, flying level, and in the various stunting manoeuvres. The heavy resistance to starting or climbing puts a correspondingly heavy pressure on the blades. This flattens them out with a reduction in pitch that allows the engine to go up to full speed and power and get the maximum thrust with the low pitch propeller.



Types of Propeller Blade Outlines

A-E-R-O-N-I-T-I-S

The Aerial Age

We are now in the aerial age,
  Ruled by the air sign Aeries.
When flying comes upon the stage,
  According to the prophecies.

* * *

Most every one that has flown,
  Women, children or men.
Say flying is coming into its own,
  And want to fly again.

* * *

'Tis getting safer every day,
  To travel through the air.
And aeroplanes are here to stay,
  Flying in bad weather or fair.

* * *

Many gave up their lives that flew,
  As pioneers of aviation.
The same as in all things new,
  Why should that kill its reputation?

* * *

Cause street cars and trains are wrecked,
  And ships sink beneath the waves.
Cause roads with wrecked autos are bedecked,
  Is that the sign they're not safe.

* * *

They're now flying all over the earth,
  From continent to continent.
And aeroplanes prove their worth,
  Wherever they are sent.

* * *

Their practicability has been awaited,
  To carry passengers and freight.
And now they are with the auto rated,
  And we see the railroads fate.

* * *

Battles on land and sea, have been won,
  By aeroplanes the aerial eye.
By giving range, etc., to guns,
  While they were on the fly.

* * *

Pictures are being taken from the air,
  Moving pictures and bird's-eye views.
Our forests are watched for fire flares,
  From aeroplanes who wireless the news.

* * *

Health flights for convalescent patients,
  Are now being taken every day.
'Tis the greatest boon to all nations.
  The greatest specialists say.

* * *

They're flying over mountains and deserts,
  Cliffs and volcanic craters.
Across the sea they soar like birds,
  Faster than any auto racer.

In Asia they have discovered
  Ancient lost cities from the air.
Over the pyramids they have hovered,
  And gained information rare.

* * *

Never was there such activity shown,
  As there is in the flying game.
In a few years it has tremendously grown,
  And made itself a big name.

* * *

'Tis a new industry with possibilities vast,
  And a future bright and glorious.
And it is agrowing so very fast,
  And considered by the serious.

* * *

Later they'll use power direct from the air,
  And fly a thousand miles an hour.
They'll travel high in atmosphere rare,
  With unlimited radius and power.

* * *

They'll rise in the air straight from the ground,
  And stand still wherever they care.
They will travel at ease without a sound,
  These coming ships of the air.

—*Henri T. Haller.*

Far above the restless ocean,
  Far above the rocky shore;
Elements in mad commotion,
  Beneath the cloudland where I soar:
Gliding through fleecy clouds,
  Cool, damp and soft,
Then with a Falcon spurt,
  Swing high aloft,
Breaking through the bank of clouds,
  To purple skies I rise,
Enveloped in a rainbow mist,
  From gorgeous evening skies.

—*Paul Xavier.*

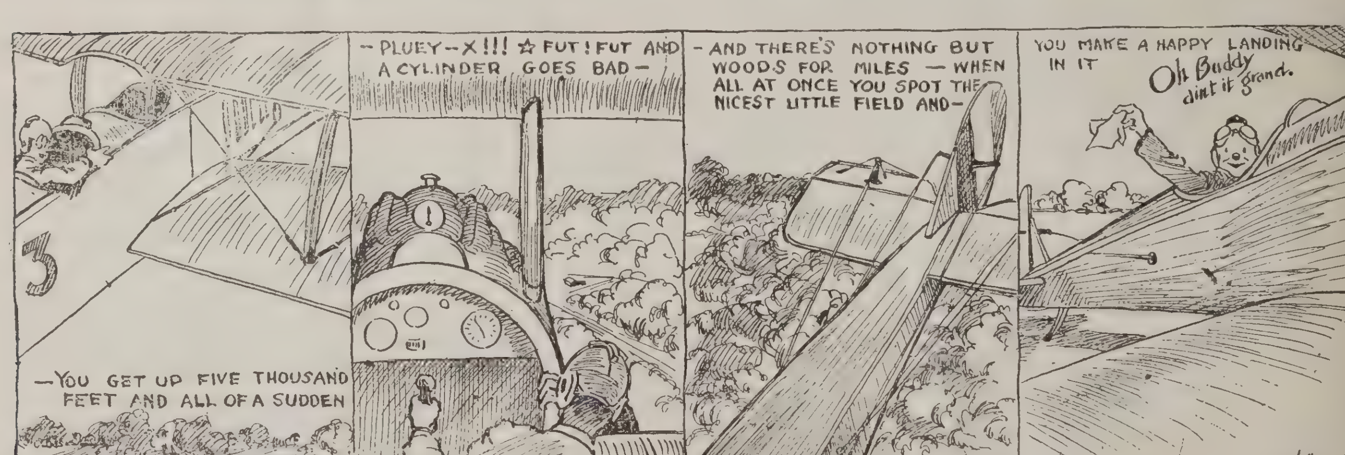
I

There was a young Pilot both skillful and daring,
  Who fell deeply in love with a sweet little Jane;
He even quit drinking and smoking and swearing,
  And almost forgot all about his good Plane.

II

One day he was flying high up in the sky,
  And dreaming of winning sweet Jane by and by,—
He said to himself, "I will hug her this how;"
  He came to with his arms 'round the neck of a cow.

—*Paul Xavier.*



AERIAL AGE WEEKLY

VOL. 13, No. 25 AUGUST 29, 1921 10 CENTS A COPY

Airscape of the Bush Country of Northern Ontario. Photographed by the Aero Service Corp., Philadelphia.

Army and Navy Board Reports on Bombing Tests

PUBLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
Subscriptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, *at the Post Office at New York, N. Y., under the Act of March* 3, 1879.

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIII NEW YORK, AUGUST 29, 1921 NO. 25

ARMY AND NAVY BOARD REPORTS ON BOMBING TESTS

THE report of the joint board of the army and navy on bombing tests off the Virginia capes must remind the layman of the problem of the conflict between the irresistible force and the immovable object.

One of the questions which the tests were to answer was whether the bombing plane, in its present state, was a generally adequate weapon against the battleship of today. To this question the report says, No; not unless the plane is operated from a land base:

"No planes large enough to carry a bomb effective against a major ship have been flown from or landed on an aeroulane carrier at sea. It is probable, however, that future developments will make such operations practicable."

What of the bombing plane as an instrument of coast defense, operating from the shore? On this point the plane scores:

"Aircraft carrying high capacity high explosive bombs of sufficient size can sink or seriously damage any naval vessel at present constructed provided such projectiles can be placed in the water close alongside the vessel."

Can battleships be made invulnerable against aerial attack? Only through the ship's offensive defense, the board indicates, for it says that "it will be difficult, if not impossible, to build any type of vessel of sufficient strength to withstand the destructive force that can be obtained with the largest bombs that aeroplanes may be able to carry from shore bases."

So if the United States had enough planes of sufficient capacity no invading fleet could reach our shores unless the enemy ships were equipped with anti-aircraft guns so marvellous as to bring down all our fliers.

As the report remarks, the development of aircraft "has but added to the complexity of naval warfare." It has not junked the battleship, for that must be kept to protect the nation against a blockade. It has rendered it necessary to make the battleship a carrier of planes and to equip it with more and more powerful anti-aircraft guns. Meanwhile the planes must be made bigger, faster and their locating instruments more accurate.

The report does not doom capital ships, but it is for all that a victory for the advocates of the plane as a tremendous weapon in coast defense. The United States could have, within a year and at comparatively small cost, a squadron of bombing planes that could fly from a shore base and destroy any battleship that came within gun range of the coast. That's a comfort to know, however the scientific duel between the builders of dreadnoughts and the makers of planes may result in future.

There are naval officers in England and America who think with Admiral Sir Percy Scott and Brig. Gen. Mitchell that submarines and aircraft have rendered the capital ship obsolete. If so, a nation that spent millions chiefly on aviation and maintained a fleet of swift carriers would be a more terrible enemy than a power that placed its dependence upon capital surface ships and neglected aviation. Granting that surface ships are necessary to a navy for police duty in time of peace and for offense and defense in war, it would be judicious not to have too much faith in them. Senator King of Utah said a sound thing when he declared that "these tests demonstrated the vulnerability of the battleship and demonstrated that while it is not obsolete as the principal unit of the fleet its strength and influence have been greatly impaired."

While exceptions may be taken by advocates of the airship as a superior unit to some of the reasoning of the Joint Army and Navy Board's report, it is an honest and courageous summing up of the case by men who felt their responsibility. Speaking of the navy alone, its aviation strength must be expanded to the dimensions of a fleet in the air, which of course will require time, and a sufficient number of swift carriers must be provided. But this will take money—a great deal of it. In the present state of the country's finances the naval appropriations cannot be increased. Will not Congress have to choose between neglecting aviation, which would be blindness to the lesson of the bombing tests at sea, and calling a halt upon the three-year capital ship program somewhere, so that money to be spent upon it could be diverted to the expansion of naval aviation?

THE NEWS OF THE WEEK

Loening Hydro-Monoplane Breaks Altitude Record

A Loening monoplane broke the altitude record for hydro machines August 16 when it reached a height of 19,500 feet at a test conducted by the Aero Club of America at Fort Washington, L. I. The instruments were sealed at the beginning of the flight by L. D'Orcy of the club, and when read at the club house, No. 11 East 38th Street, showed the previous record of 9,603 feet had been broken by nearly 10,000 feet. The barographs and instruments will be sent to the Bureau of Standards at Washington, where they will be calibrated and the official altitude will be announced.

The aircraft was piloted by former Lieut. Commander David McCulloch of the Navy, who was pilot of the N C-3, which attempted the trans-Atlantic flight in 1919. With him were Grover C. Loening, inventor of the plane; L. R. Grunman and L. D'Orcy. The ascent was made in fifty minutes, and Mr. Loening said the machine easily could have climbed to 23,000 feet. He was forced to descend because of the discomfort caused by the changing temperature—75 degrees Fahrenheit at the ground to 28 degrees at the peak of the ascent.

The machine is the first hydro-monoplane to be developed in America for commercial work. It is of the pusher propellor type, and carries a 400 horse power Liberty motor. The cabin is about the size and shape of a sedan automobile body, and the motor is mounted above and behind this. Before the attempt to break the altitude record, the machine attained a speed of 130 miles an hour when flown near the ground.

The Aero Club in a statement was enthusiastic over the flight. It said the performance of the plane shows American-built machines are superior to foreign sea-planes of this type designed especially for sport and commercial purposes. The Contest Committee of the club was represented at the test by Caleb S. Bragg, Chairman, and Morris G. Cleary. Those who watched the flight included Congressman F. C. Hicks of the Committee on Naval Affairs; Commander Cabaniss of the U. S. S. Langley; Lieut. Commander J. A. Davis and Augustus Post, Secretary of the Aero Club.

Aerocruiser Corporation Test New Motor

The Aerocruiser Corporation of America, with offices in St. Louis and Washington, D. C., announce that they have just completed successful preliminary tests of their powerful new type of gas motor, the Tandem motor, at Detroit.

With this powerful specially designed motor the Company Engineers claim that they will be enabled to drive a 530 foot Aerocruiser, having gas capacity of 3,800,000 cubic feet (over one million feet greater than the ZR-2), through the air from New York to London or to San Francisco in 24 hours in non-stop flights.

The aerocruiser is a new type of rigid dirigible balloon, an American invention, having no resemblance in its formation and construction to the Zeppelin type or socaeld "cigar-shaped" airships.

One of the 530 foot types of this airship powered by a battery of their specially designed Tandem motors should carry 200 to 250 people from New York to London through the air at better than 100 miles an hour. This claim made by the company engineers has been ratified by competent aeronautical experts, based on the power to be derived from the special engine.

The new type engine and the new type airship is the result of eighteen years of intensive endeavor to bring out a "best" in their types.

The Aerocruiser Corporation of America was organized in 1917 to take over the patents of the inventor, Thomas A. Finley. An eleven foot model of the Aerocruiser is now on exhibition at the Washington offices of the Company in the Union Trust Building.

Research University to Have Aeronautic Course

In cooperation with the three divisions of the Air Service of the United States Government, Research University at Washington, D. C., will start a course on September 19 in aeronautics. This will be one of the most thoroughly conducted schools for aviators in the country. Leading experts in the Army Air Service, the Navy Air Service, and the Air Mail Division of the United States Post Office will cooperate in planning and administering and teaching courses in the new school.

From the start Research University School of Aeronautics will meet all requirements of the Government and will obtain the use of aeroplanes and other means and methods of instruction.

Students are expected from all parts of the United States to attend these courses, and work will be arranged both by correspondence and residence instruction. For the benefit of those who are employed in Washington during the day, the courses will be held in the evening two or more days of the week from seven or eight to ten o'clock.

Research University is a cooperative institution of higher learning in the District of Columbia, run on a non-profit-making basis, largely for the education of federal employees of the District.

The School of Aeronautics is in the College of Commerce. Persons who are interested in the school either for resident or correspondence study should write to President Louis W. Rapeer, 20 Jackson Place, D. C.

Suggest Dirigible Circle Globe

A round-the-world voyage for the dirigible ZR-2 after it has been given a proper reception in this country upon its delivery here from England was proposed to the Navy Department August 16 by the World's Board of Aeronautical Commissioners, Inc., of which Charles J. Glidden is secretary. The commissioners are now represented in eighty-one countries, and promise to look after the technical needs of the big air voyage if the trip is made.

It is proposed to have the ZR-2 start westward across the continent, then over the Pacific via Honolulu, Yokohama and Shanghai, thence to Rome, Paris and London. The distance computed through these points is 22,847 miles, and could be accomplished in about seventeen days flying time as the commissioners figure it.

Motion pictures on the screen while flying through the clouds at 90 miles an hour! History's first aerial movie show was on board the eleven-passenger hydroplane, Santa Maria, at the Chicago Pageant of Progress—and the first picture ever to be projected 2,000 feet above the earth's surface was "Howdy Chicago!" produced by the Rothacker Film Co. for the Chicago Boosters Club, for use in telling the world about the windy City's selling points. A screen was hung in the forecabin of the machine; a DeVry suit-case projection machine fastened firmly in position and connected with an electric light socket. The projectionist pressed the button and the audience beheld cinema views of Chicago while flying over Chicago. Before the flight it was feared that the vibration of the giant hydroplane as it shot through the air at 90 miles an hour would seriously interfere with the screening. But it did not. This historic flight demonstrated the practicability of movie entertainment for transatlantic aerial commuters in the days to come

Omaha Enthusiastic Over Aero Meet

Gutzon Borglum, world famed sculptor, designer of "Stone Mountain, Georgia," "Lincoln," and other famous works in this country, will design a medal for the first *International Aero Congress,* to be held in Omaha, November 3-5, 1921.

The medal will symbolize the work of the American airmen during the war and the future possibilities of aviation in this country. It will be cast in bronze and will be presented to distinguished visitors at the Congress to commemorate the event.

Mr. Borglum expects to have the medal finished soon acording to the latest word received from him by the heads of the Aero Club of Omaha, Inc., which is sponsoring the big Congress.

The entire city of Omaha joined in preparing the new Municipal field, to be used for the meet.

Thursday, August Eighteenth, was set as the day for clearing the field which was full of trees, hummocks and everything that would tend to wreck an ordinary aircraft.

The Holt Manufacturing Company furnished a twenty ton and a ten ton Holt caterpillar tractor which jerked the trees out by the roots with the greatest ease.

Former flyers, members of the Aero Club of Omaha, Inc., rolled up their shirt sleeves and helped remove the trees. They were assisted by American Legion men and businessmen of Omaha, who made short work of clearing the big 106 acre flying field.

Ladies of the Prettiest Mile Club furnished luncheon for the workers.

Profits, if any, from the first International Aero Congress are to be used to purchase the field which is to be donated to the city.

According to Major Ira A. Rader, head of the Seventh Army Corps Area, and other army officers, the field is the most favorable in the country for a Municipal landing field. It is absolutely flat with the Missouri River on one side and a railway on the other, offering facilities for flying boats as well as the advantage of loading planes on the field. It is only fifteen minutes ride from the heart of the city, adjoining paved streets and boulevards.

Defects Reported in ZR-2

LONDON.—Unless the dirigible ZR-2 sails for the United States during the next three of four weeks, she probably will have to wait until next year, because of weather conditions, according to *The London Observer,* which asserts that defects in the dirigible, which had been kept secret for four or five weeks, are no longer a secret.

During the first trials of the ZR-2, the newspaper says, a tendency of the great balloon to "hump" developed, and an inspection revealed that certain girders had bent and that lattice work had buckled under the strain. Remedial measures were taken, including considerable reinforcement of the framework along much of the airship's 695 feet of length. This involved additional weight, the newspaper states, and a slight increase in the load the dirigible can lift.

In addition to this structural trouble, The Observer asserts, the ZR-2 has been handicapped by engine difficulty, but it adds that the element of weather is the one which is causing the present delay in the final tests.

Shackleton Takes Plane

Sir Ernest Shackleton"s' ship, the Quest, has a special deck on which is housed a specially constructed aeroplane. This will be Sir Ernest's fourth journey to the Antarctic, and he contemplates that the aeroplane will be invaluable in reaching points inaccessible by boat.

MANUFACTURERS AIRCRAFT ASSOCIATION REQUEST CO-OPERATION

HAVING in mind that at the moment there is a Federal bureau whose function it is to register aircraft and pilots, the Manufacturers Aircraft Association has requested AERIAL AGE to give nation-wide publicity to a questionnaire which it has prepared. The Association wants this information to be in a position to supply statistics to the various governmental departments and civilian bodies endeavoring to frame definite plans and regulations as part of a national policy for aerial navigation.

Following is the questionnaire, which it is hoped everyone will fill out and mail promptly:

Report for Year October 1, 1920—*October* 1, 1921.
(Must be received not later than Oct. 7.)

1. Did you make report to Aircraft Year Book for 1921?....
2. Name of organization (if incorporated, say so and give capitalization and names of officers)......................

....

3. Location of mail office. Town...........State...........
4. Location of terminals:
   (a) Owned or leased...................................
   (b) Size ....
   (c) Number and size of hangars........................
   (d) Shop and repair facilities........................
5. Equipment—give number, name and type of all aircraft and engines operated, thus,—One Aeromarine Model 50-B.-2 flying boat, Wright engine; One Curtiss J.N.-4, C-6 engine, etc.

....

....

....

....

6. Approximately how many flights of all kinds have you made from Oct. 1, 1920, to Oct. 1, 1921?................
7. What was average duration of flight?..................
8. What is approximate total mileage for this period?........
9. How many passengers have you carried during this period? ....
10. How many pounds of package freight have you carried in this period? ....

....

11. What do you charge per passenger per short flight?.......
12. What is your charge per pound per mile for package freight? ....
13. Between what cities do you fly?
    (a) Regularly? ....
    (b) Occasionally? ....
14. What is your charge per passenger per mile for such inter-city flights? ....
15. Accidents.

    NOTE: Our purpose is not to make public accidents suffered by each company, to the consequent embarrassment of the company; it is to get as accurate an idea as possible of the number and cause of accidents and to draw helpful deductions. Your co-operation is earnestly requested. The name of your company will not figure in any connection with accident figures.

    (a) How many accidents of all sorts have you had in the period of this report?..........
    (b) How many fatalities?...................
    (c) How many injuries?.....................
    (d) List the more serious accidents and give their cause somewhat as follows:

    ....

    ....

    1. Lack of public landing fields...........
    2. Lack of air routes......................
    3. Lack of weather reports.................
    4. For judgment by pilot...................
    5. Fault of accessory (specify)............
    6. Fault of plane (specify)................
    7. Fault of engine (specify)...............
    8. Fault of gasoline or oil (specify)......

Remarks ....

....

....

Please send us interesting photographs and copies of literature prepared and distributed by your organization.

Noteworthy details of your operations: ....

....

....

....

Mail to: Manufacturers Aircraft Association, Inc., 501 Fifth Avenue, New York City.

The AIRCRAFT TRADE REVIEW

Aerial Lines Carry 2,007 Passengers in Three Months

The first official report covering commercial flying operations to and from New York just forwarded to the Bureau of Aeronautics, Navy Department, by the Aeromarine Airways shows that the first three months of operations 2,007 passengers were carried 28,171 miles in the air by four flying boats without a single injury. These figures are exclusive of crews, each boat carrying a pilot and mechanic every flight.

The report covers the first quarter of the sight-seeing service around New York City, and services to and from nearby seashore resorts. The only mishap recorded in the report occurred Sunday, August 7th, when the flying boat "Ambassador" made a forced landing with six passengers in the violent storm while flying from Atlantic City to New York.

It points out that the landing was safely made alongside a yacht belonging to the president of the Company, and that the passengers, and crew were safely transferred, and the flying boat successfully towed back to the hangar. This forced landing occurred in a storm which was so violent that it actually tore up pavement in the city streets, and blew down garages, and resulted in serious accidents in other forms of transit in and about the city. The flying boat easily weathered this terrific storm and landed its passengers without injury. All four were impressed with the stability and safety of the flying boat in the terrific storm, and readily made the second flight.

Spraying Trees From an Aeroplane

The novel experiment of spraying a grove of trees from an aeroplane, the first ever attempted in the United States, was made on August 4th over the farm of Harry A. Carver, near Troy, Ohio, to prevent further ravages of worms which have twice practically defoliated this grove of 5000 Catalpa trees. The plane, piloted by Lieut. John A. Macready, Air Service, and carrying E. Dormoy, McCook Field, designer, who constructed the sifter used to spray the arsenate of lead powder, flew within 20 or 25 feet of the top of the trees, releasing the powder which was carried by the wind and air currents from the ship's propeller into every part of the grove. Treatment of trees in this manner saves much time and labor, as an aeroplane in a few minutes can do work which would require a number of men and many pump sprays several days. The effect of this experiment will be watched with interest by entomologists and forestry experts in many parts of the country, especially in the east, where a similar scourge is working havoc with many magnificent elm trees. The idea of utilizing an aeroplane for this purpose originated with Mr. C. R. Neillie, of Cleveland, who came to Troy to witness the first trial. Mr. H. A. Gossard, Chief of the State's Department of Entomology, also came to witness and assist in the experiment.

Mr. Dormoy is understood to be working on a new hopper which will simplify spraying of the powder, and McCook Field officials have indicated their willingness to cooperate with farmers and with the Department of Agriculture in combating insects and tree infection.

Achievement for Curtiss OX

Many have said an aeroplane is obsolete in six months and not suitable to fly one year after it has been built or in service. This may hold true for some cases but evidently does not hold true for this small machine.

During the week of July 11, 1921, this aeroplane, which is engined with a Curtiss OX5, flew from Los Angeles to Bishop, Calif., in four hours five minutes, a distance of 287 miles. The ship was piloted by Mr. Wally Timm with Mr. Leon Short as passenger. Gasoline sufficient to reach Lone Pine was carried and destination reached in three hours and twenty minutes. The altitude at Bishop is 4,000 feet and Lone Pine 4,300 feet. To reach either of these points it is necessary to cross desert and mountainous country. The return trip was made in three hours forty-five minutes. The only expense shown was for gasoline and oil. The story of Mr. Timm and Mr. Short regarding the trip speaks well for Mr. Timm's ability to handle the machine and select a beautiful and pleasant trip.

This is the first time a machine engined with a Curtiss OX5 has been able to make the trip, for several attempts have been made in other machines.

The history of this little machine only goes to show that it is not unreasonable to expect a great deal from a machine. The machine making this trip is over five years old.

The Aerial Mail Service

The Air Mail Service will soon place in operation six remodeled aeroplanes of the DH type on the transcontinental air mail route between New York and San Francisco. These planes are army planes and by changing the wing and body capacity they will carry double the amount of mail now carried in the Air Mail Service by this type of plane. Eight hundred pounds of mail or 32,000 letters will be carried on the remodeled plane with the same amount of fuel and the same man power, one pilot.

The first of these remodeled planes was inspected at Bolling Field, Washington, this morning by Postmaster General Hays and his assistants, Work, Shaughnessy and Glover, with other postal officials.

The cost of remodeling these planes is about $3 000 per plane whereas the cost of a new plane is about $15,000.

These planes will be compared on the most difficult part of the transcontinental route, which is over the Rockies, flying along with one of the planes now in use which carries only 400 pounds of mail. It is expected ultimately to use this type of remodeled plane on the entire route which will increase operating capacity 100 per cent.

The remodeled plane is the latest type of ship for mail carrying. The experience of the Post Office Department with a number of different types of plane has resulted in the conclusion that the best type of plane for use in the Air Mail Service is a single-motored plane carrying approximately 800 pounds of mail, or 32,000 letters, with a high speed of 115 miles per hour, landing speed of 50 miles per hour, and a cruising endurance of four hours.

The remodeled plane is en route from New York to San Francisco on its initial trip. It will be sent to the Minnesota State Fair held at the Twin Cities, September 3-10, together with Aeroplane No. 12, which made the initial trip May 15, 1918, when the first air mail route was established between Washington and New York. This old plane has been in service for a period of three years and five months. It is a Curtiss model JN4H with a 150-H.P. Hispano-Suiza motor. It has a carrying capacity of 200 pounds of mail or approximately 8,000 letters, with a cruising endurance of three and one-half hours. Its speed is 75 miles per hour. The records show that this plane has flown over 40,000 miles.

During July of this year the Air Mail Service flew 13,150 miles with mail, carrying 224,000 letters, with a percentage of performance of 100% New York to Chicago; 99% Chicago to Rock Springs, Wyo., and 98% Rock Springs to San Francisco. The mileage for the transcontinental route is 2,630 miles from New York to San Francisco.

During the year ended June 30, 1921, 1,770,658 miles were flown and 44,834,080 pieces of mail were carried, with a percentage of performances for the year of 85.96 per cent. There are 49 pilots, 380 mechanics and 86 planes used on the transcontinental route. There are air stations at New York, N. Y., Bellefonte, Pa., Cleveland, O., Bryan, O., Chicago, Ill., Iowa City, Ia., Omaha, Neb., North Platte, Neb., Cheyenne, Wyo., Rock Springs, Wyo., Salt Lake, Utah, Elko, Nev., Reno, Nev., and San Francisco, Cal. The Post Office Department is now negotiating at other points for Joint Army and Post Office fields.

C. F. Egge, Superintendent of the Air Mail Service, is in San Francisco to arrange for using Crissy Field of the Army at that place.

Air Service Orders

Following to Ellington Field: Major Coleman, F. H.; Capts. Broberg, O. W.; Elmendorf, H. M.; Guidera, A. M.; Holmberg, J. B.; Skeel, B. E.; 1st Lts. Ladd, A. K. ;McBride, B. R.; Summers, J. D.; Wilson, J. H.

Howard, Capt. D. B., to Balloon School, Ross Field.

Giles, Capt. B. F., to Carlstrom Field.

Shangraw, 1st Lt. C. C., to Arcadia, Florida.

Rouse, 1st Lt. H. F., to Comdg. Officer, Langley Field.

Hodge, 1st Lt. G. E., to Chief of Air Service.

Lynch, 1st Lt. J. E., to Washington, D. C.

Carpenter, 1st Lt. E. J., to Bolling Field.

THE DISTANT COMPASS

By WALTER FRIEDENSBURG*

FOR a long time, small fluid compasses were almost exclusively used on aircraft. Such a compass consists essentially of a number of comparatively weak magnets which, supported by a hollow float, turn on a needle point in a vessel filled with alcohol and water. This would answer for ordinary use, if there were on the aircraft no iron parts and no other magnets, like starters, magnetos, dynamos, etc.

The compensation of these disturbances by small magnets is only a makeshift and by no means frees the compass readings from error. The many neighboring movable iron parts, like steering devices, weapons, tools, bombs, etc., even key-rings, knives and the like in the pockets of the occupants, exert, according to their size and proximity, a varying influence on the compass readings which, on the aircraft, are hardly controllable and cannot be corrected, any more than the constantly varying influence of the above mentioned magnets.

Every deviation of the aircraft from the horizontal position, in either a lateral or longitudinal direction, likewise exerts an influence on the compass readings. Thus there are generated, especially by sudden changes of position in curved flight, oscillations of the card which may even increase to the complete revolutions dreaded by every aviator.

The oscillations of the compass card, due to those magnetic and mechanical influences, are indeed deadened by the compass liquid, but this friction is operative not only in the indicated instances, when the card, with the magnets, oscillates with reference to the compass vessel, but also when the system is at rest and only the vessel turns, as in every curving flight. In the latter case, the card is also carried along and indeed just so much more, the weaker the magnet system and, accordingly, its directive power. On the other hand, the greater the directive power of a magnet system, the greater are its errors of deflection from neighboring masses of iron. These errors call for stronger compensation magnets which, the stronger they are, the more they weaken the directive power of the system. Out of this endless circle there was yet on an aircraft only the unsatisfactory compromise. The employment of a reliable magnetic compass, free from objections, was impossible and one was compelled to make the best of inaccurate and unsatisfactory compasses.

An improvement of the properties of the aeroplane compass to real serviceableness in aerial navigation is only possible then, when the disturbing causes are eliminated. The Navy prescribes for every compass on shipboard a minimum distance within which there must be no iron. This is impossible on an aeroplane, since there is no such amount of room free from iron from within view of the pilot or observer. It is difficult to install a compass on an aeroplane at all, on account of the limited space.

On the other hand, the remedy by placing the compasses in magnetically somewhat more favorable position, for instance, on the upper or lower supporting deck, presents many other disadvantages: inconvenient reading of the compass, difficult and inaccurate steering by such a distant instrument, compulsory cessation of the possibility of taking bearings, as also the impossibility of using adjustable indicators and other accessories, mistakes in reading oblique and side views, insufficient protection of compass against cold and wet, as also against the force of the air current which, in such a location, often tilts the compass or even upsets it. Moreover, only small compasses with weak magnets can be used, since a higher directive power cannot be employed, for reasons already given, and the still unavoidable proximity of iron and because the limited space prevents the installation of larger compasses.

Against the use of the ordinary compass on an aeroplane there are various further practical considerations. Steering by a reference mark and the general use and complete utilization of such a compass requires too much experience on the part of the pilot, especially of one with little or no knowledge of navigation, while even an experienced and educated pilot finds it too strenuous to watch the card, with its finely divided scale, and, at the same time, attend to the numerous details of managing the aeroplane, observing, fighting and keeping constant watch of the ever-increasing number of instruments. The increasing demands on the pilot emphasize the need of direct communication between him and his observer, in order to do away with time-robbing attempts at speech, signals and makeshifts.

For solving all these problems, there is now a new device, the "distant-compass" constructed by Carl Bamberg, Friedenau, and improved in 1918 by the Seaplane Division and practically tested in comprehensive experiments and use at the front. Since this compass does not need to be in sight of the aviators and can be located far from all iron parts, it can be as powerful as those used on ships. This compass is free from error down to the fraction of a degree and at least as reliable as those on large ships. The most favorable location on the ordinary type of aeroplane is from one to one and a half meters behind the rear seat in the fuselage, where the compass, enclosed in a wooden case (see Fig 1), is protected from the wind and weather. The magnet system is the same as demonstrated its stability in the submarines. Its use on aeroplanes has greatly increased the accuracy of steering in comparison with the compasses formerly used, and,

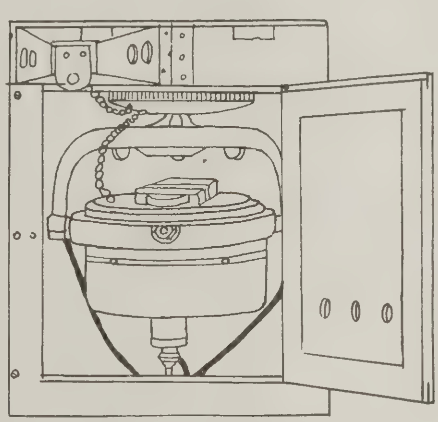


Fig. 1.

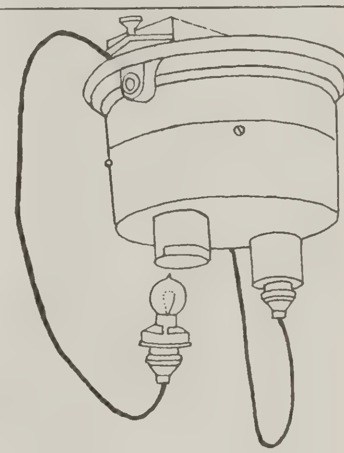


Fig. 2.

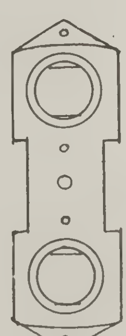


Fig. 3.

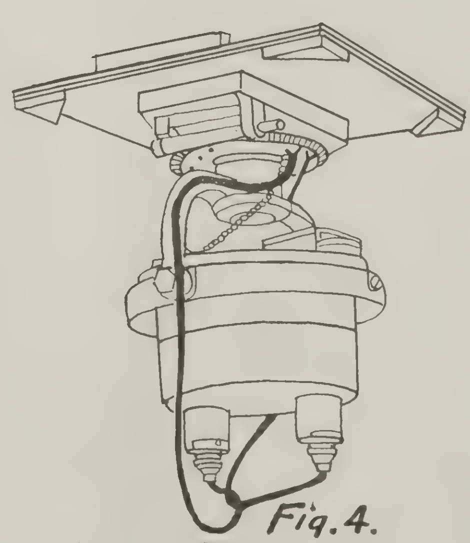


Fig. 4.

* From "Zeitschrift für Flugtechnik und Motorluftschiffahrt," August 15, 1920.

even while flying in clouds and bad weather, there were no harmful oscillations nor revolutions. Not much compensation is usually necessary, since in every type of machine it is possible to find a location entirely free from magnetic disturbances. The improvement thus obtained consists first in eliminating the compensation, which always requires an expert, and further, in the fact that the directive power of the compass is not weakened by compensation magnets.

The magnet system of this compass is supported in the usual manner in a compass-vessel filled with alcohol and water. In the bottom of the vessel there are two lighting devices (each consisting of a small electric bulb and "condenser"), which throw two cones of light, sharply defined by the condensers, up through the compass liquid (Fig. 2). Both light-cones fall on two selenium cells (Fig. 3) which are applied in an air- and water-tight cap to the vessel (Fig. 4). The electric resistance of the selenium is lessened by the illumination, so that, for instance, an electric current passing through it can cause the pointer of an indicator to move. For the distant-compass, a special precision galvanometer with suitable scale serves as course-indicator (Kurszeiger), with radiumized marks and pointer. (Fig. 5).

The magnet system carries a diaphragm which, in a certain position, simultaneously intercepts both light-cones and leaves both selenium cells dark. If now the compass vessel (Kompasskessel) is rotated about its vertical axis, whereby the magnet system remains constantly in the north-south direction, one or the other cell passes out of the diaphyagm shadow into one of the light-cones and the pointer moves to one side or the other. In this way, every swing of the compass vessel can be read on the course-indicator and, indeed, so that the amplitude of the oscillation of the pointer is proportional to the deviation from the course. This result is obtained by giving the proper oblique shape to the diaphragm, so as to cause a gradual strengthening or weakening of the illumination and therewith a proportional decrease or increase of electrical resistance in the selenium cells. This method of transmitting the compass indications differs from most other known methods in that it is accomplished without influencing the compass card of weakening its directive power.

Any seaplane or aeroplane provided with this device can be steered exactly in the desired direction, since every deviaation from this direction causes a rotation of the compass vessel with reference to the magnet system, which is immediately indicated. The pilot only needs to turn the rudder right or left according to whether the pointer moves to the left or right. This device has two fundamental advantages over the ordinary compass. First, the pointer moves a relatively longer distance than the card of an ordinary compass, a deviation of 15° from the course, causing t motion of about 5 cm. in the former case to anly 1 cm. in the latter case, making the accuracy of the reading about five times as great for the former. Second, this compass, like all the other instruments on the aeroplane, is read on a fixed scale by means of a mobile pointer and thus spares the aviator the special thought required, on all other instruments, for reading the mobile card scale with reference to a fixed steering mark.

If the compass vessel is rotated a certain angle, say 65°, with reference to the longitudinal axis of the aeroplane, then the new course, if flown according to the course-indicator, will evidently deviate 65° from the original direction, since one of the selenium cells receives the light and thereby brings the course-indicator to one side, until, by the turning of the aeroplane itself 65°, it comes again into the shade of the diaphragm. At any time during flight, any desired new course can be established by turning the compass vessel the desired angle with reference to the longitudinal axis of the aeroplane. The compass vessel had for this purpose a suspension device which can be readily rotated by means of a worm gear (Fig. 4).

For this purpose, the compass is placed in the rear part of the fuselage or other iron-free location. The turning of the compass vessel, and with it the establishment of the course, is then effected by means of a flexible shaft (Fig. 7) which is within reach of the aviators and is turned by a crank. By this shaft a compass card near the crank is simultaneously turned exactly the same angle as the compass vessel, so that on this course-giver (Kursgeber) (Fig. 8), the angle and thus the compass course can be read. Naturally, in such a system with a flexible shaft, several course-givers and course-indicators can be installed, for the pilot and observer and any other persons in any part of the aeroplane, who are thus enabled to observe and assist in the navigating.

The heat generated by the electric lamps prevents the freezing of the compass liquid, even in very cold weather. The minimum current required for the compass installation is about 10 watts. This current can be obtained by connecting the system with a source of electric current already on the aeroplane, but is usually supplied by a small airscrew double generator of especial reliability (Fig. 9), specially constructed for this purpose, with an output of 40 volts, 6 milliamperes for the indicator circuit, which flows through the selenium cells, and 8 volts, 2 amperes for the electric lamps, and weighs only 1.8 kg. (4 lbs.). The tension of the generator is kept constant between 3700 and 7500 r.p.m. by an automatic regulator according to the Sumner principle. The best location for the generator is in the air current from the propeller. The number of r.p.m. required for the work of the compass system was found in a test to be about half the r.p.m. of the engine.

The weight of a complete distant-compass set, with two course-givers, course-indicators, generators, cables, shaft, etc., was about 9 kgs. (20 lbs.).

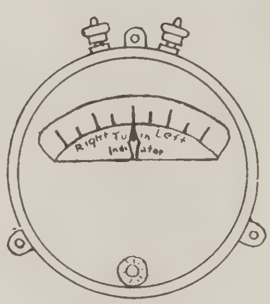


Fig. 5.

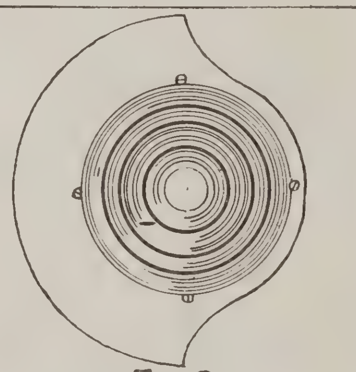


Fig. 6

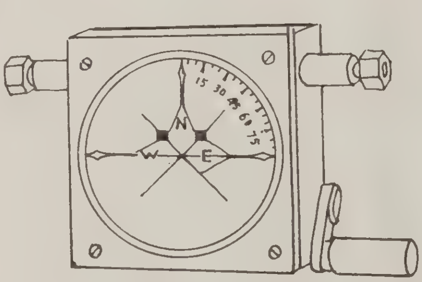


Fig. 8.

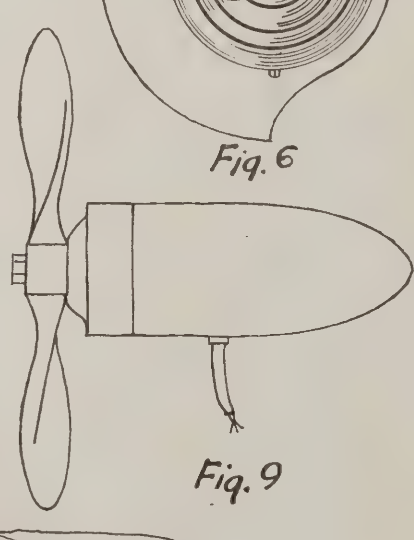


Fig. 9

Fig. 7.

Practical Application of the Distant-Compass

The course to be steered (for example, 130°) is set by the pilot or observer, while the crank of one of the course-givers is turned so that this degree number of the compass card comes opposite the steering mark of the course-giver. Thereby the whole system is adjusted to the 130° course and the pointer of the course-indicator oscillates until the aeroplane is brought exactly on this course. If, for instance, the previous course was 45° N.E., then, after setting it at 130°, the pointer lies hard to the left. The pilot then turns the rudder continuously to the right, in order to bring the pointer to the middle. When the aeroplane, in turning to the right, reaches course 100°, then the pointer, with the further turning of the aeroplane, beginning to move slowly, lies at 130°, it stands on the middle point. If the aeroplane turns too far, say to 135°, then the course-indicator moves cor-

respondingly to the right until, by steering to the left, the aeroplane is brought back to the course and the pointer to its middle position. Further holding to the course is accomplished in the same manner, since, on the slightest deviation of the aeroplane from its course, the pointer moves to the corresponding side and indeed proportionally to the deviation, so that the aviator is always given the measure for the degree of correction in steering. Up to 30° on either side, the motion of the pointer is proportional to the deviation from the course. Above 30° the pointer remains in the same position. This angle of 30° has been found suitable in practice for an ordinary aeroplane, but it can be varied at will, according to the size and corresponding sensitiveness of the aeroplane (or airship), by resistance, from 5° to 40°.

Every change of course during flight is accomplished in the manner indicated by setting one of the course-givers for the new course and steering according to the course-indicators, without the necessity of any communication between the occupants by signs, notes, etc. Also the observer or any other occupant can, without any closer understanding, call the attention of the pilot to an object that the latter has not noticed, or accurately indicate a target, since the pilot has only to steer according to the pointer, the accuracy of which makes it possible to steer for the smallest goal.

If it should happen, in curved flight or great changes of the course, that the course set on the course-indicator should be exactly opposite to that followed by the aeroplane at the time (for example, set on the course-giver: East 90°, aeroplane flying west = 270°), the course-indicator in this special case, when the difference is just 180°, stands in its middle position, which results from the two selenium cells being located at 180° apart. This position, however, hides no possibility of error, because it is immediately evident that (likewise following from the construction) the course-indicator swings in the opposite direction than when the aeroplane is flying on the course set. If the aeroplane, as assumed in the example, is flying west and turns only one degree to the right of this course, the pointer swings to the left and the pilot must therefore steer to the right. Thereby he continually goes further to the right from his false west course, for the pointer remains on the left until the aeroplane is again on the east course for which the course-giver is set. Only then is the pointer again in its correct middle position. The second and opposite middle position of the course-indicator makes it possible therefore for an aeroplane that has deviated by a large angle, (around 180°) from its correct course, to be always shown the smaller angle and therefore the shorter way back to its correct course. Every aviator must therefore become accustomed to following the course-indicator blindly, then, whether in clouds or fog, even in battle, after completely losing his bearings, he will immediately return to his correct course, without danger of the compass whirling, even from the most violent motions of the aeroplane.

The sensitiveness of the pointer, which indicates deviations of fractions of a degree from the direct course, enables the aviator to fly straight ahead and horizontally in clouds and at night. Only this condition enables the use of aeroplanes for photogrammetric surveying which requires the holding of a straight line and further imparts genuine accuracy to observations from an aeroplane and from the earth, which unconditionally require straight lines, like speed measurements, etc. True, there already exists in the Drexler Gyroscope Indicator (Kreiselssueranzeiger) a highly sensitive instrument for facilitating direct flight, but its value is confined exclusively to the aerodynamic field, since it only shows whether, for the time being, the aeroplane is flying straight ahead or in a curve, and does not enable the holding of a single definite course, like the distant-compass course-indicator.

Furthermore, the distant-compass not only makes possible the general control of one's bearings, but also the accurate determination of compass, directions and variations, even without seeing the compass itself, because the card of the course-giver, as long as the aeroplane continues on the course set for it, always corresponds to the true magnetic compass card since the course-givers are always mounted parallel to the longitudinal axis of the aeroplane. A variation device attached to a course-giver is more convenient and utilizable for compass variations than when attached to the sensitive and mobile compass itself.

The advantages and possible applications of the distant-compass are so numerous that it has become one of the most important instruments for aircraft. This was also demonstrated by its adoption in 1918 for all former naval seaplanes, with the exception of combat aeroarmy aeroplanes. This device is a very planes, as well as for certain types of important aid for commercial, as well as military aviation. By its advantages it increases both the safety and economy of aviation. The accuracy of course-steering, which the distant-compass has made many times greater than that hitherto attainable, lessens fuel consumption, facilitates unconditional reaching of one's goal even under the most trying circumstances, and diminishes the intellectual and nervous tension of the pilot, which is of especial importance in long distance commercial aviation.

It is not the purpose of this article to discuss the application of this invention to sea ships. The parallels are readily drawn. Even the farthest evolution possibilities open up favorable vistas. Thus, on a ship, there has been successfully substituted for the indicating instrument a relay enabling the compass to operate the rudder directly. Such a device, which has already been finished and tested, demonstrates the possibility of dispensing with the pilot and replacing him by an automatic and considerably more accurate steering-compass. The lateral steering of an unmanned aeroplane rests on the same principle.—*Translated for the National Advisory Committee for Aeronautics by D. M. Miner.*

KODAKING FROM AN AEROPLANE

By SEYMOUR WEMYSS SMITH

TO the majority of pilots and practically all aeroplane passengers the possibilities of taking photos from the air are regarded as extremely remote, as the impression is widespread that for taking aerial views a special camera and lens equipment is needed. Of course, many pilots have taken snap shots with hand cameras, but usually these turn out to be entirely inferior photos, in which the landscape is more or less of a blur. However, it is possible to secure excellent aerial pictures without going to the expense or trouble of using a specially constructed camera. There are a few rules to be remembered, and simple ones at that, and once mastered, aerial photography is an open book.

The writer took three of the photos reproduced herewith while a passenger in one of the aeromarine R. S. naval model seaplanes on a flight from Hartford (Conn.) to New York City, a distance of nearly 200 miles by the water route, via the Connecticut River and Long Island Sound. Before leaving five extra film packs were secured. And then with our tiny camera (a Premo No. 12 model, with a Zeiss 6:3 lens and a compound shutter working up to 1/300 second) slung across our shoulder, we clambered into the plane and were ready for the trip.

In order to be certain that some worth while photos would be secured the writer "shot" sixty films between Hartford and New York, and fully fifty of these turned out to have been more or less successful. The films used in the Premo No. 12 are only 2¼ by 3¼ in size, the familiar Brownie size. However, the high speed shutter and the excellent lens provide a negative which will easily enlarge up to 8 by 10, or even to a larger size, without losing the detail of the original. There are many hand cameras which could duplicate the work produced herewith. Any of them are capable of good work, provided the shutter and lens permit.

In many ways the small cameras are ideal for aerial photography. They are light, the films are inexpensive and the speed of operation often compensates for the reduced size of the film. For instance, at least twelve of the 2¼ by 3¼ films can be exposed in the same time which would be required for half as many of the larger sizes. And when flying, speed of operation is an essential. One moment the ideal view is here, a moment later it is gone.

Many of the larger cameras are not as well suited to aerial work as the smaller sizes. For instance, the Graflex, splendid all around camera that it is, does not prove satisfactory in the air. The hooded focusing device, or the reflex feature, is practically useless and the quickly adjustable lens is apt to get jarred out of focus in the air. If a Graflex is used, it is advisable to find what is the "infinity," or maximum distance mark for the lens, and then lock it in place, so that the focus does not wobble out of range when flying. The focal plane shutter of the Graflex is, of course, an advantage. However, there are few occasions on which the 1/300 of a second of the fastest small camera shutters does not prove entirely adequate.

Aerial birdseye of the center of Hartford, taken at altitude of 400 feet while flying over East Hartford meadows. This view of the city would be impossible without the aeroplane, which allows one to maneuver into the position for the most artistic view

With the camera pointed directly downward, giving a map effect, extreme speed is not necessary and 1/100 of a second will often give a sharp negative, and the writer has known of some fliers who had reasonable success with small box cameras. However, the various small speed cameras, with high grade lens and shutters, give the most desirable results.

In enlarging from the small negatives remember that by stopping down the lens of the enlarging camera a much stronger result is secured. For instance, by stopping the enlarging lens to F 16 or even F 22 an immeasurably better result is obtained than with the lens "wide open." And give sufficient time to enlarging. A long exposure on slow developing paper gives the best result. If the flier don't do his own work let him ask that care be used in this respect, to preserve the full detail. Ordinary tank development will usually give good results with the negatives.

So far as a finder is concerned, successful results can be secured by merely pointing the camera in the direction of the object to be photographed. However, the direct view finders, attached to the side or top of the camera and giving a direct view of the object, are a decided asset in aerial work.

For photography from an aeroplane with a hand camera, the writer would suggest that 500 to 800 feet is about the most desirable altitude, while the shutter can be set at 1/300 of a second and the lens at F 6:3, taking all photos at the same speed. Variety may be the spice of life, but in aerial photography, unless the flier is experienced, it would seem better to set the shutter and lens for a fixed speed before the flight begins.

The North business section of Hartford, a few hundred yards away from the view in No. 1. Both of these photos were enlarged from $2\frac{1}{4}$ by $3\frac{1}{4}$ film. Lens was used at stop f.8 and speed of shutter was 1/300 second

The illumination on a bright day is tremendous and sometimes it may be desirable to stop the lens down to F 8. However, a hand camera and a little patience, and the would-be aerial photographer will discover that he can easily obtain highly satisfactory aerial photos. Even the occasional passenger will find he is well repaid in results for taking a camera aloft.

Map of Saybrook Point, where the Connecticut River merges with Long Island Sound. Altitude probably about 1,500 feet. Lens used at f.8 opening, shutter speed 1/100 second

View of the Connecticut River bridge at Hartford, with the plane of the Fokker from which it was taken visible at the top (note wooden construction of wing). Plane was banking at the time. Observe autos and cars crossing bridge and craft in river

---

The Gallaudet Engine Gear

Providence.—A power unit for large aeroplanes consisting of three Liberty engines geared to a propeller with a clutch, claimed by its designer and builder, Edson F. Gallaudet, to assure nonstop flights from New York to Liverpool in twenty hours or less, and also to be one of the most formidable of military machines, was given an official test August 22 by Lieutenant R. Christensen, engineer on the NC-1 on its transatlantic flight.

The arrangement has been under construction for six years, and the completed product will soon be delivered to the Navy Department, as will two others which are now in the course of construction at the plant of the Gallaudet Aircraft Corporation at East Greenwich.

It is claimed that Mr. Gallaudet is the first to gear three Liberty engines to a propeller with a clutch. Two Liberty motors are side by side, with one in back, it being the plan of operation to run two engines with one always in reserve. In the test three 400-horsepower engines were geared to an eighteen-foot propeller, the arrangement being installed on a high platform.

General Squier's Work in Paris

American backing of wireless telephony as the big thing of the near future was the feature of the international wireless conference which closed August 22 after having been in session for two months. The American delegation, headed by Major General George O. Squier, chief of the Signal Corps of the United States army, came to Paris with a definite program. Most of this program is said to have been adopted, although the conclusions of the conference will be kept secret until they are presented to the various governments by their delegates.

The Americans pictured Presidents and Premiers of the future speaking directly among nations and emphasized the overwhelming importance of wireless telephony in supreme moments, as well as the necessity for aiding in its development.

The activity of the Americans in "selectivity," or the development of the equivalent of the private line wireless, as opposed to the present "party line," where anyone may listen in on a conversation, met with recognition by the conference.

Among the fourteen principal questions with which the conference dealt and adopted was a recommendation by the Americans that certain waves be assigned in each country, with treaty provisions limiting each country to the use of instruments adapted to those wave lengths so that the result would be secret wireless.

EXPERIMENTAL REINFORCED PLYWOOD TRUSS RIBS

By B. C. BOULTON, Aeronautical Engineer, McCook Field

(*Concluded from page* 541)

The next development was the design of a series of ribs with a chord length of 15 feet. As it was desired to determine the value of reinforced plywood truss ribs for both deep and shallow wing sections, one set of ribs was designed with the USA-27 section and one with the USA-5 section. Each of these has a high lift coefficient and is suited for a heavy wing loading. In Table V are the data upon which the original design for the first set of ribs was based.

TABLE V

Chord, 15 ft., or 180 in.
Wing section, USA-27.
Front spar at 13 per cent of the chord from the leading edge.
Rear spar at 65 per cent of the chord from the leading edge.
Wing loading, 11¼ lbs./sq. ft.
Load factor, 4.
Rib spacing, 21 in.
Required ultimate strength for rib, 1,200 lbs.
Triangular loading with apex one-third way back.
Triangular loading with apex at leading edge.
Test loads spaced 6 ins. apart.
Subdivided Warren truss with diagonals adjacent to spars in compression used for web system.
Compressive strength of wood, 5,500 lbs./sq. in., based on net section[1] reduced for column action by formulas
$C=5{,}500-0.48/c\ (L/p)^2$ for short columns and $C=c\times 1{,}580\,000\ (L/p)^2$ for long columns.
Modulus of rupture, 8,500 lbs./sq. in based on net section.
The allowable stress for the chord members in combined bending and compression was calculated by the formula,

$$F_a=\frac{f_b}{f_b+f_c}(8{,}500-C)+C.$$

Fixity coefficient for chord members=3.
Fixity coefficient for diagonal members=3 in plane of the truss and 2 in a plane normal to this plane.
The lengths of all web members were taken as the distances between the intersections of the center lines of the chord and web members.

The plywood employed in the construction of all the 15-foot truss ribs was 3/16-inch spruce poplar plywood with the spruce face plies horizontal. All plies were of equal thickness. All reinforcing and cap strips were spruce of ¼-inch thickness and varying width.

A determination was made of the direct stresses for the loading given in Table V, considering the rib a pin-jointed truss. It was assumed that in actual test the loads would be all applied to the lower chord and spaced at 6 inches. The amount of each load was computed by plotting the position of the loads on the triangular loading diagram and calculating the area of the diagram for a distance of 3 inches on each side of each load. If the total area of the triangle represented the total load desired, the small areas represented the concentrated loads. The panel loads for the truss were computed by assuming that the sections of the chord between panel points were simple beams and distributing the concentrated loads accordingly. A diagonal was assumed in place of each spar, and one-half of each spar reaction was assumed to be applied to the member or members on each side of the spars. The stress diagram for this rib is shown in figure 11 and the key diagram in figure 12. A stress diagram was also made for the members between the leading edge and the front spar, using the loading for high incidence with the apex of the triangle at the leading edge. The bending moments produced by the concentrated loads on the lower chord are given in figure 13. They were calculated by assuming the chord a straight beam continuous between spars. To provide for the contingency of having the wing covering on the upper surface of the wing sewed to the upper chord, the bending moments, produced by a uniformly varying load whose intensity at any point equals 70 per cent that of the loading diagram, were computed assuming the upper chord a straight beam continuous between spars.

In the actual tests there were certain deviations from the conditions assumed. The loading was triangular with the apex of the triangle 25 per cent back from the leading edge. The concentrated loads, all applied on the lower chord, were spaced 3 inches apart. A summary of the test data on all the 15-foot plywood truss ribs is given in Table VII. Complete data on these tests may be found in McCook Field Report Serial No. 1425.

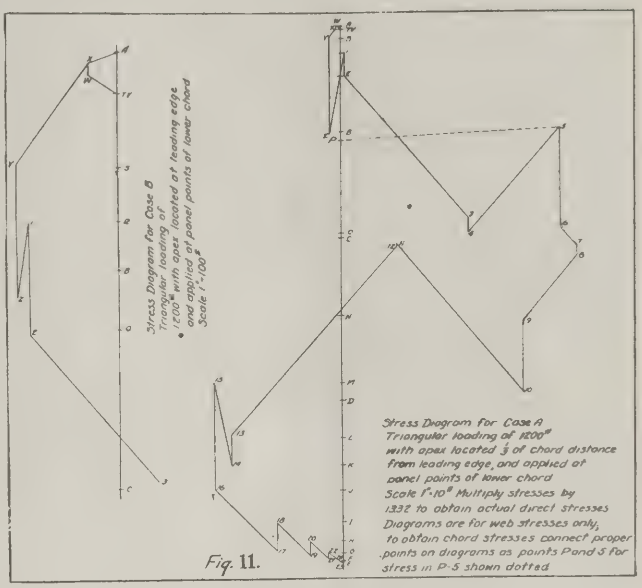


Fig. 11.

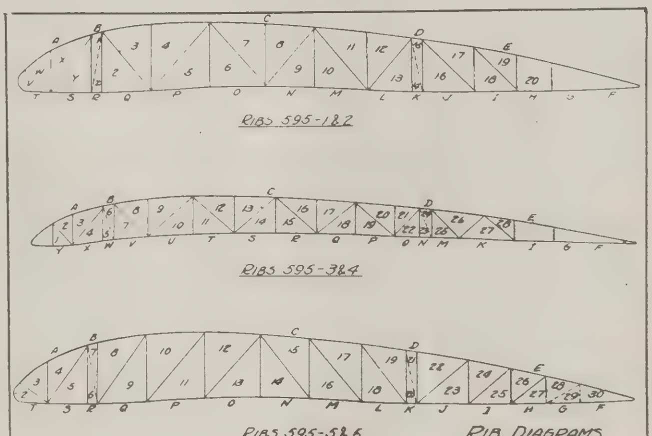
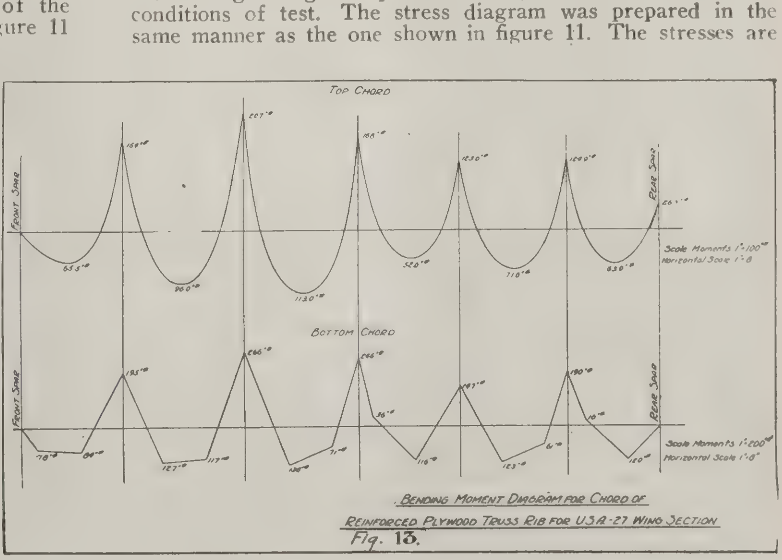


Fig. 12.

The design of the ribs with the USA-5 wing section followed closely the methods described above. This design also employed the subdivided Warren truss type of construction with the heaviest stressed diagonals in compression. The only change in the data was the use of a loading with the apex of the loading triangle 25 per cent back, to correspond with the conditions of test. The stress diagram was prepared in the same manner as the one shown in figure 11. The stresses are



BENDING MOMENT DIAGRAM FOR CHORD OF REINFORCED PLYWOOD TRUSS RIB FOR USA-27 WING SECTION
Fig. 13.

[1] In computing the net section, the effective area of the plywood in the chords and diagonals was assumed to be two-thirds its gross area.

listed in Table VI. In figure 14 are given the bending moments in the upper and lower chords between spars.

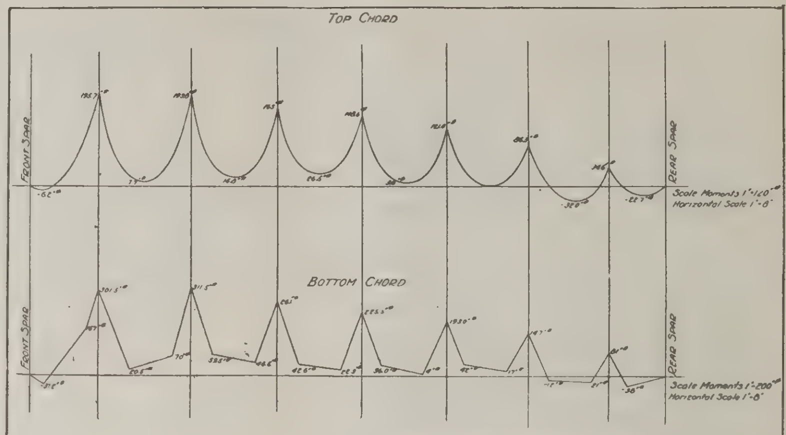
The revised ribs of the USA-27 section were designed with a Pratt truss web system in which all diagonals were tension members[1] and all verticals, compression members. The truss stresses were determined graphically as in the previous designs. A complete analysis was made for the test loading with the apex of the loading triangle 25 per cent back, and, as in the other cases, an analysis was made with the apex at the leading edge to determine the members in the nose section. The bending moments in the chords were assumed to be the same as those given in figure 13. The fixity coefficient in the plane of the truss for the web members was reduced from 3 to 2. In a plane normal to that of the truss this coefficient was unchanged. The effectiveness of the plywood in resisting stress when the direction of the grain of the plies was at 45° to the direction of stress was more accurately allowed for than in the first two designs. In figure 15 are given curves obtained from five sets of tests on plywood, in each of which the line of action of the load made different angles with the direction of the grain. No data were available for spruce-poplar plywood, so that strengths with the load applied parallel and perpendicular to the grain were computed, assuming an ultimate tensile strength of 12,000 lbs./sq. in. parallel to the grain and 600 lbs./sq. in. perpendicular to the grain. In compression the corresponding values were taken as 6,000 lbs./sq. in. and 600 lbs./sq. in. A curve similar to the one for 1/28 birch and 1/16 poplar plywood was then drawn through these two points. For the diagonal web members the value of the unit tensile or compressive strength at 45° was found. The ratio of this value to the tensile or compressive strength of spruce was taken as the measure of the effective area or moment of inertia. Corrected values for these properties were then combined with the corresponding properties of the reinforcing strips in computing the strength of the members. Figure 10 is a drawing of this rib.

Before testing 595-6, members 9-10 and 11-12 were reinforced in plane perpendicular to rib.

The apparatus used in these tests is shown in figure 17.

All of the ribs can be reduced in weight about 4 ounces by cutting down the size of certain members. This reduction will be partly offset by the necessity for increasing the size of a few members. The resultant decrease in weight may be taken as 2.5 ounces. The original and revised weights are both given in Table VIII and the strength:weight ratios in this table are based on the maximum load sustained by each rib, and its revised weight.

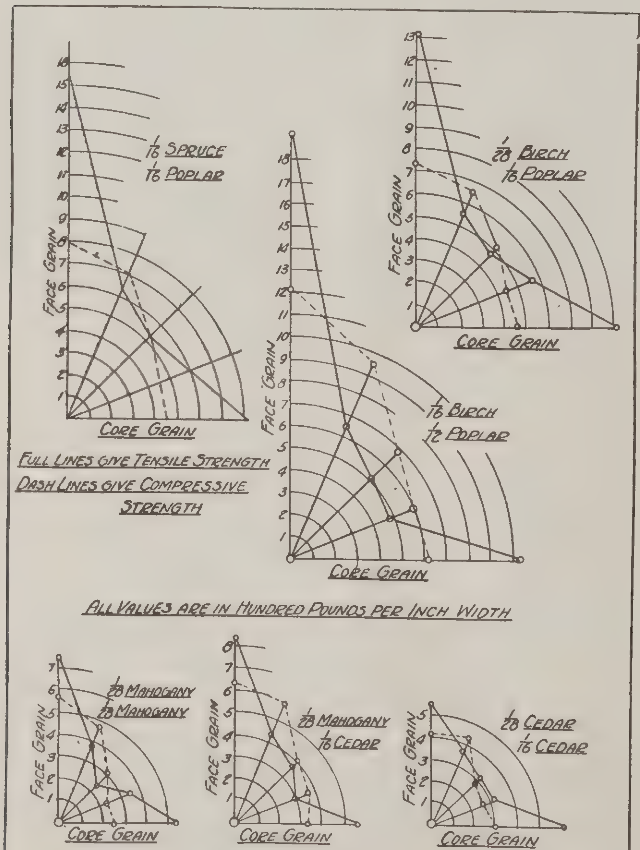
[1] All tension members were limited by the compression occurring with reversed loading assumed equal to 40 per cent of the tensile stress.



Bending Moment Diagram for Chord of Reinforced Plywood Truss Rib for U.S.A.-5 Wing Section
Fig. 14

The strength:weight ratios given in Table VIII do not represent the best that can be done with this type of construction in 15-foot ribs. In the design of these ribs no information was available relative to the modulus of rupture of the T sections of the chords or the coefficients of fixity for the web members. Due to the assumptions which were made, the chord members were too large and the web members too small. In Table IX are given data relative to strength properties of sections of the chord cut from three ribs. The results, though consistent, are extremely high. It is not advisable to use a value for the modulus of rupture greater than 10,300 lbs./sq. in. based on the net section, this being the value for spruce.

A study of the failures of the web members gives information relative to the proper fixity coefficients. In Table X are given the computed coefficients for the web members which failed in test. In several cases coefficients both in the plane



Strength of Plywood in 5 Directions
Fig. 15.

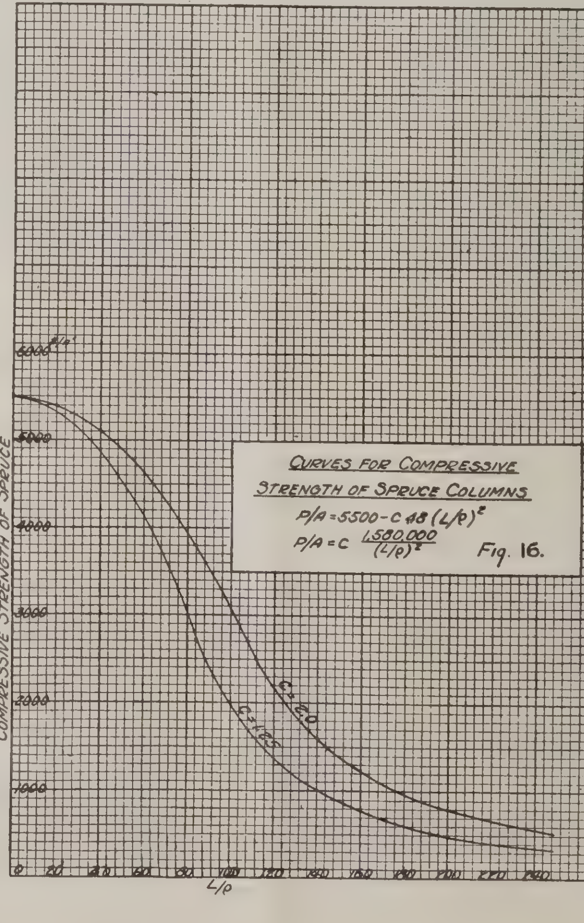


TABLE VI

Direct Stresses in Rib Trusses for Load of 1,200 Pounds

Ribs.			Ribs.			Ribs.	
595-1 and 2.			595-3 and 4.			595-5 and 6.	
Chord member.	Stresses.		Chord member.	Stresses.		Chord member.	Stresses, loading 1.
	Loading 1.	Loading 2.		Loadin 1.	Loading 2.		
A-W	— 11	— 62	A- 3	— 10	— 92	A- 3	— 7
A-X	— 12	53	B- 6	— 7	—255	A- 4	— 7
B-Z	— 25	—178	C- 8	374	95	C- 8	7
C- 3	286	....	C- 9	371	....	C-10	276
C- 4	284	....	C-12	890	....	C-12	475
C- 7	523	....	C-13	890	....	C-15	382
C- 8	528	....	C-16	752	....	C-17	95
C-11	125	....	C-17	753	....	C-19	—296
C-12	127	....	C-20	10	....	E-22	—325
D-15	—291	....	C-21	10	....	E-24	—184
E-17	—149	....	D-24	—465	....	E-26	—110
E-19	— 75	....	E-26	—322	....	E-28	— 70
E-21	— 33	....	E-28	—154	....	E-30	— 50
E-23	— 10	....	E-30	— 66	....	F-30	50
E-14	— 10	....	E-32	— 20	....	F-29	50
F-24	9	....	F-33	0	....	G-27	70
G-22	36	....	G-31	45	....	H-25	110
H-20	73	....	I-29	115	....	I-23	180
I-18	148	....	K-27	242	....	K-18	— 92
J-16	287	....	M-25	462	....	L-16	—382
K-14	248	....	N-23	402	....	M-14	—510
L-13	248	....	O-22	402	....	N-13	—505
M-10	—405	....	P-19	—456	....	O-11	—475
N- 9	—402	....	Q-18	—455	....	P- 9	—270
O- 6	—487	....	R-15	—900	....	R- 5	25
P- 5	—487	....	S-14	—898	....	S- 2	15
Q- 2	— 8	148	T-11	—726	....	....	....
R- 1	— 7	148	U-10	—726	....	....	....
S-Y	27	174	V- 7	— 6	250	....	....
T-V	0	0	W- 5	50	279	....	....
A-V	0	0	X- 4	50	278	....	....
....	....	....	Y- 1	0	0	....	....
V-W	13	60	1- 2	15	125	2- 3	10
W-X	— 7	19	2- 3	5	10	3- 4	0
X-Y	— 26	—213	3- 4	— 62	—295	4- 5	— 30
Y-Z	—216	—218	4- 5	— 37	— 75	5- 6	— 45
Z- 1	185	....	5- 6	—190	— 95	6- 7	—174
1- 2	51	—185	6- 7	138	30	8- 9	455
2- 3	—420	....	7- 8	—507	—480	9-10	—358
3- 4	— 35	....	8 -9	— 38	....	10-11	305
4- 5	310	....	9-10	468	....	11-12	—260
5- 6	—223	....	10-11	—178	....	12-13	45
6- 7	— 56	....	11-12	—215	....	13-14	—208
7- 8	— 21	....	12-13	— 27	....	14-15	205
8- 9	—191	....	13-14	12	....	15-16	—315
9-10	—161	....	14-15	—153	....	16-17	438
10-11	433	....	15-16	193	....	17-18	—435
11-12	— 3	....	16-17	— 11	....	18-19	620
12-13	—566	....	17-18	—373	....	22-23	180
13-14	70	....	18-19	—102	....	23-24	—127
14-15	193	....	19-20	585	....	24-25	90
15-16	—242	....	20-21	0	....	25-26	— 70
16-17	—199	....	21-22	—587	....	26-27	48
17-18	68	....	22-23	— 28	....	27-28	— 46
18-19	—106	....	23-24	178	....	....	....
19-20	29	....	24-25	—200	....	....	....
20-21	— 56	....	25-26	—203	....	....	....
21-22	11	....	26-27	108	....	....	....
22-23	— 33	....	27-28	—132	....	....	....
23-24	0	....	28-29	56	....	....	....
....	....	....	29-30	— 70	....	....	....
....	....	....	30-31	26	....	....	....
....	....	....	31-32	— 36	....	....	....

Loading 1 is triangular with apex one-third way back.
Loading 2 is triangular with apex at leading edge.
Loading 3 is triangular with apex one-fourth way back.

TABLE VII

Test Data on 15-Foot Truss Ribs

Ribs.	Maximum load.	Deflection at center.	Deflection at trailing edge.	Failure.	Alterations for next test.
595-1	1,000	0.292	0.170	Column failure in member 2-3.	Member 2-3 reinforced in both directions.
	1,000	.273	.185	Member 5-6 heavily stressed.	Member 5-6 reinforced in plane perpendicular to rib.
	900	.241	.150	Member 8-9 bent in plane of rib.	Member 8-9 reinforced in plane of rib.
	1,170	.301	.188	Member 12-13 failed in plane of rib.	Member 12-13 reinforced in plane of rib.
	1,000	.305	.129	Member 12-13 failed in plane of rib.	Member 12-13 reinforced heavier and flange of lower chord members Q-2, P-5, O-6, N-9, M-10, L-13, and C-4 reduced in depth ¼ in. to $\frac{3}{16}$ in.
	1,000	.285	.098	Member 0-6 deflected greatly perpendicular to plane of rib.	
	1,175	.340	1.29	Member 5-6 failed in plane of rib.	
595-2	800	.219	1.50	Member 2-3 heavily stressed in plane of rib.	Member 2-3 reinforced in plane of rib.
	850	.208	.165	Apparatus broke.	
	1,070	.290	.234	Member 5-6 failed in plane of rib.	Member 5-6 reinforced in plane of rib.
	1,100	.329	.250	Members 8-9 and 16 - 17 deflected heavily in plane of rib.	Members 8-9 and 16-17 reinforced in both directions.
	1,200	.335	.248	Member 18-19 deflected perpendicular to rib.	Member 18-19 reinforced by adding another reinforcement strip in plane perpendicular to rib. Members P-5 and O-6 had web cut down ¼ in. and cap strip between wing beams reduced to ¾ in. width.
	1,200	.352	.208	No failure.	Members P-5 and Q-2 reduced web $\frac{3}{16}$ in.
	1,125	.320	.174	Member P-5 failed in plane of rib by combined bending and compression.	Member P-5 reinforced.
	750	.215	.117	Member 5-6 deflected heavily in plane perpendicular to rib.	Reinforcing of 5-6 made heavier.
	1,200	.384	.165	No failure.	
595-3	675	.350	.100	Member 19-20 deflected in plane of rib.	Member 19-20 reinforced by ¼ by $\frac{3}{16}$ in. strips.
	850	.388	.140	Tension failure in 9-10.[1]	Put additional strip ¼ by $\frac{3}{16}$ in. on other side of 9-10.
	600	.264	.100	Tension failure in 9-10.[1]	9-10 member reinforced.
	1,200	.580	.310	Member 17-18 deflected heavily perpendicular to plane of rib.	
595-4	820	.430	.190	Tension failure in 19-20.[1]	Put additional reinforcing strip on 19-20.
	610	.285	.120	Tension failure in 19-20.[1]	19-20 reinforced full length.
	800	.399	.078	9-10 near tension failure.	9-10 reinforced full length.
	1,100	.515	.140	17-18 deflected perpendicular to plane of rib.	
595-5	800	.290	.095	9-10 deflected heavily perpendicular to rib.	Heavier reinforcing on 9-10 perpendicular to rib.
	1,000	.375	.055	11-12 deflected heavily perpendicular to rib.	Heavier reinforcing on 11-12 perpendicular to rib.
595-5	1,200	0.454	0.128	15-16 deflected heavily perpendicular to rib.	
595-6	1,200	.485	.238	15-16 deflected heavily perpendicular to rib.	

[1] Tension failure due to very poor gluing.

of the rib and perpendicular to the plane of the rib are given, though failure occurred in one plane only. The low values in several cases for the coefficient in the plane of the rib were probably due either to severe strains produced by previous failures or to bending moments transferred from the chord members through the plywood at the joints. For future design work it is recommended that fixity coefficients of 1.25 perpendicular to the plane of the rib and 2 in the plane of the rib be used. These are conservative rather than average values. In computing web members the effective area of the plywood as determined from the charts in figure 15 should be used. In figure 16 are given column curves plotted for the above coefficients to be used in the design of web and chord members.

It is recommended that a fixity coefficient of 2 in the plane of the rib be used in the design of chord members. Any eccentric moments due to initial curvature of the chord between panel points or caused by deflections resulting from the lateral loads may be neglected. The wing covering may be assumed to prevent deflection perpendicular to the plane of the rib. A column length equal to 0.25 the sum of the panel lengths on each side of any panel point should be used in investigating the strength of the chord at such points. It is also permissible to consider the actual section of the chord at panel points, instead of the normal section, as effective in taking the peak of the bending moment. Care should be exercised, however, in computing the strength of the chord at a section an inch or so to either side of the panel point where the normal chord section begins.

The allowance of reasonably generous fillets at all joints is important, especially for members carrying large tensile stresses. The radius of fillets between members at about 45°

TABLE VIII

Rib.	Ultimate load.	Original weight.	Estimated weight.	Load. / Weight.
	Pounds.	*Ounces.*	*Ounces.*	
595-1	1,175		...	...
2	1,200	54.7	52.2	23.0
3	1,200	48.5	46.0	26.1
4	1,100	47.4	44.9	26.7
5	1,200	59.6	57.1	21.0
6	1,200	58.0	55.5	21.6

to each other should not be less than ¾ inch. If the fillet is between two members which are nearly at right angles the radius should not be less than 1½ inches. In the case of heavily stressed members these minimum radii should be 1 and 2 inches, respectively. The tangents points of fillets on each side of a member should be opposite each other. In general, fillets serve to stiffen the members and to aid in transferring stress from the reinforcing strips on the web members to the plywood web. The normal section of a web member should not be reached until the stress in the reinforcing strip has been developed through the glue. The stress on the glue should not exceed 1,000 lbs./sq. in.

General Conclusions

The comparisons made in this report show that the reinforced ply-wood truss type of rib construction is probably superior to any other type of wood construction so far developed. The simplicity and low production cost of this rib are its most essential features. These features are due to the small number of parts to be handled, the fact that none of the members have to be jointed or fitted, and that all the web members are of uniform section throughout their length. There is none of the work of putting in screws or wrapping and gluing all the joints. The amount of ply-wood wasted is, of course, large, but its cost is small in comparison with the reduced cost of the labor.

TABLE IX

Data from Sections of Chords Tested in Bending Span 18 Inches; Loading Third Point.

Rib No.	Chord No.	Cross section.[1]			Net section.[2]		
		Moment of inertia.	Modulus of rupture.[3]	Modulus of elasticity in 1,000 lbs.	Moment of inertia.	Modulus of rupture.[3]	Modulus of elasticity.
595 1	S-16 and I-18...	0.01318	12,200	1,630	0.00389	16,200	2,170
2	N-9 and M-10..	.01823	11,910	1,605	.01365	15,900	2,140
2	O-6 and N-9....	.02055	[4]8,040	1,423	.01544	[4]10,400	1,895
3	U-10 and T-11..	.05627	11,100	1,292	.04239	14,550	1,718

[1] Full cross section of chord.
[2] Cross section of chord without the vertical lamination of web.
[3] Modulus of rupture in tension.
[4] Brashy specimen.

These ribs are very stiff and rigid in comparison with other types, as shown by the deflections in Tables II, IV, and VII. The strength: weight ratio of these ribs is higher for a given chord length than for any other type except the Barling, which is expensive to build. With the information now available relative to the design of these ply-wood truss ribs their strength can be accurately computed, making a test almost unnecessary. Their strength is very uniform provided a reasonable amount of care is taken in the gluing. As is the case with all type of built-up ribs, the gluing must be about 50 per cent efficient. Two points should be emphasized if the gluing is to be reliable: First, the glue and water must be carefully weighed out in the proper proportions and thoroughly mixed; second, sufficient glue must be applied to both surfaces of the joint, and then as much of this glue as possible squeezed out of the joint by nailing on the reinforcing strips with fairly heavy brads. More of these brads should be used near the ends of the web strips than in the center. No difficulty has been experienced in the joint between the cap strips and ply-wood. It is believed that a spruce-poplar ply-wood is superior to a birch-poplar ply-wood of the same weight. One of the chief reasons for this is that a better glue joint can be made with the lighter ply-wood.

TABLE X

Fixity Coefficients for Web Members

Rib.	Member.	Perpendicular to plane of rib.	In plane of rib.	Load at failure.
1	2–3	[1]1.4	2.8	1,000
1	5–6	1.2	3.4	1,000
1	8–9	....	1.8	1,000
1	12–13	[1]1.55	1.7	1,000
2	2–3	....	2.3	800
2	5–6	[1]1.3	3.6	1,070
2	8–9	....	2.0	1,100
2	16–17	....	3.3	1,100
2	18–19	1.35	....	1,200
3	17–18	.95	[1]1.85	1,200
4	17–18	.8	[1]1.7	1,100
5	9–10	1.6	[1]2.8	800
5	11–12	1.4	....	1,000
5	15–16	1.5	....	1,200
6	15–16	1.5	....	1,200

[1] Failure not in this plane.

The tests on these ribs indicate clearly that a moderately shallow rib can be constructed with a weight equal to or less than that for a rib with a deep section.

Although the tests showed no difference between the strength of ribs of the subdivided Warren truss type and those of the Pratt truss type, it is believed that the former are better. In production the attachment of the ribs to the spars could not be as good as in the ribs tested. For this reason a compression member adjacent to the spars is superior to a tension member, as the latter type is much more difficult to hold in place.

For production reasons, it is recommended that further work be done on the development of reinforced ply-wood truss ribs with all the reinforcing in the chords and web on one side only. Because of eccentricities such a rib would not be as efficient as a symmetrical one.

It is also recommended that the Martin type of construction be developed for short ribs of deep section.

Fig. 17.

NAVAL and MILITARY AERONAUTICS

Night Bombing Work at Langley

Night flying is the program on in full force by the men of the Provisional Air Brigade stationed at Langley Field. Experimental flights are being made every night except Thursday, Saturday and Sunday with a view to familiarizing the pilots with the use of flares and operation of the new Sperry device for ascentaining horizontals and relative positions of aeroplanes while flying at night or through heavy clouds or fog.

The present program is being carried out preparatory to the bombing exercises now scheduled to take place in the early part of September, when army aeroplanes will once more have an opportunity to demonstrate their efficacy as weapons of offense against battleships, this time by locating and sinking an armored vessel at night.

The U. S. S. Alabama is the ship set apart for this phase of the bombing maneuvers. While it is not known at this time whether the ship is to be anchored or under power, it is said that the successful carrying out of the project in either case will be the strongest possible argument in behalf of the practicability of air craft as a military weapon.

Airships May Fly Across Continent

Across the continent to California and thence to Nome, Alaska, and return to California, is the contemplated flying program for two of Langley Field's airships, marking not only the first attempt at a transcontinental flight in lighter-than-air craft, but also the most comprehensive flying project as yet outlined for dirigibles in this country.

The D-3 and D-4, which are the ships designated for the big undertaking, are being thoroughly overhauled at Langley Field; new motors are being installed and a number of changes are being made, preparatory for the flight. The ships have been in constant use at the Field all summer, taking an important part in the bombing maneuvers conducted by the First Provisional Air Brigade, when they were used for observation and photographic purposes.

While the proposed trip will be of the utmost interest and value to those selected for the undertaking, it will also demonstrate the cruising ability of the present type of non-rigid airship. Only two landing fields, affording hangar space, will be encountered on the journey across the continent, one at Akron, Ohio, and the other at Brooks Field. Engineering and aerial navigating skill of the highest order will be rejuired to carry the ships over the mountains and across the plains successfully, while the subsequent flight into the far northland has all the glamor of romance and anticipation of discovery. Practically all officers of the lighter-than-air section of the Field have volunteered for the trip, although but a limited number will be required for the work.

Four officers and three enlisted men, including two engineers and one radio operator will be assigned to each ship. While final selection of the men for the trip has not been made at this time, it is said that Majors Strauss and Peek will probably be included as senior officers.

The change of station for the two ships is being made at this time, for two reasons: first, the arrival of the monster airship, "Roma" from Italy and designated for service at Langley Field, makes it necessary to remove some of the ships from the big balloon hangar in order to house the larger craft properly. In the second place, Ross Field is now being used for the primary training in airships, so that with the arrival of the D-3 and D-4 the complete airship training leading to rating as airship pilot, may be carried out.

Philippine Government to Relinquish Its Air Service

There is a possibility that the Philippine Air Service will be taken over by the Army or by a private enterprise, as the Insular Government is desirous of being relieved of the expense of maintaining the service. A conference between officials of the Army and the Philippine Government was held on July 8th with regard to the proposed transfer, but no decision was reached in the matter. A private company, of which E. J. Hamilton Stevenot is the head, is said to be making a bid for the aeronautical property of the Philippine Government, but until a proposition in writing is submitted no action can be taken thereon. Further meetings will be held between the Military and Insular authorities with a view to the ultimate settlement of this matter.

Airship Makes Trip to Camp Dix

One of Langley Field's big blimps, the C-2, under the command of Major Pagelow, who was accompanied by Major Strauss, Lieuts. Reed and Anderson and Sergeants Ryan and Gabriell, sailed into Camp Dix recently for the purpose of giving the West Pointers encamped at that place practical instruction in this branch of the service. During the time spent at Camp Dix, seventy cadets were taken up on flights.

Radio Activities

At Langley Field communication was established with Bolling Field and tests are being carried on in an effort to determine the best working wave lengths. While using 450 meters, undamped, Bolling Field comes in at this station loud enough to be read all over the room without keeping phones on, although this wave length is unsatisfactory for regular work with them as there is quite a bit of commercial traffic and, consequently, the interference is very bad. While using 830 meters undamped they are not so strong as on 450 meters, but there is less interference. As a result of the test, it has been decided that 350 meters is the most practicable wave for them to use. The 109 set was used in this test. In a later test, Bolling Field changed its wave to 750 meters, which makes reception of signals much easier, eliminating much of the interference made by ships in Hampton Roads.

At the request of the Air Mail Station at College Park, Md., this station is furnishing local weather reports twice daily. They report the successful reception of the same.

In Panama successful results with radiophones were obtained in a series of problems for the observation of fire for the coast defenses of Cristobal. Excellent one way communication was maintained throughout the majority of problems. As a preliminary to the firing of these problems an officer from each of the defenses firing was detailed at France Field for a short period of instruction. Many difficulties were encountered by both the Air Service and the Coast Artillery and practical demonstrations were given as to just how communication should be handled.

A central power plant is being developed with the generator directly connected to the engine. The results of test show that it is satisfactory as a source of electrical power for radio transmitting sets, but with the present apparatus cannot be used as a source of power for radio receiving sets. Until suitable apparatus is developed, a small storage battery will be used for the radio receiver.

A Warning to Pilots Flying at Mitchell, Roosevelt or Curtiss Fields

The Curtiss Aeroplane & Motor Corporation advises that the Air Mail have erected two wireless poles 150 feet high, about 100 yards north of the Curtiss factory at Garden City. Electric lights will be placed on these poles to avoid danger of collision at night.

Pilots using Mitchell, Roosevelt or Curtiss Fields at Garden City should take care in landing that they do not come so low as to collide with these poles.

More About the Radio Controlled Car

In a previous issue of AERIAL AGE we gave a description of the radio controlled car at McCook Field, the mystifying gyrations of which caused so much wonderment and comment amongst spectators who witnessed its performance. Just recently the citizens of Dayton were given an opportunity to witness the performance of this vehicle, which was operated through the downtown traffic directed by Captain R. E. Vaughn, of McCook Field, who designed and perfected the device.

Just at the hour when morning traffic is the heaviest, a little three-wheeled car, about eight feet long, of cigar-shaped construction, left the monument on North Main Street and made its way south, blowing its horn and observing all traffic rules. Vaughn guided the car solely by means of a wireless set installed in an automobile in which he followed the car at a distance of 50 feet.

At Fifth and Main Streets, the car turned east to Jefferson and North to Monument Avenue. Here motion pictures were taken.

The entire control of the car was brought about through the wireless antennae and outfit with which both machines were equipped.

FOREIGN NEWS

Swiss Military Air Service Records

The following information regarding Swiss air work is published: 12,380 flights of a total duration of 3,532 hours were carried out by the Swiss Air Force during 1920.

Accidents were as follows: 2 machines slightly damaged, 3 bad landings (machines standing on nose), 2 machines turned turtle (forced landings), 1 crash in getting off (machine totally wrecked).

No one was injured in these accidents, but there were two deaths as the results of crashes during non-service flights. The training of airmen, which included an average of 10 hours flying per month, paid special attention to the development of safety in flying.

Tokyo Civil Air Port

The Japanese authorities, it is announced, are making preparations for establishing an aerial port near Tokyo. Urawa, the capital of the prefecture of Saitama and situated at a distance of 30 minutes by train from Tokyo, is reported to be the probable site.

Mr. Hata, the Vice-Director of the Aviation Bureau, states that the aerodrome which is contemplated by the authorities is of an entirely different nature from the military aerodromes at Tokorozawa, Kagamiga-hara, etc., and is intended to be the first of many aerodromes of the kind to be constructed in Japan, Korea, Saghalien, etc. It is to comprise a training ground, landing-place, warehouses, customs house, hospital, wireless installations, a signal tower, etc., and also equipment connected with aviation at night to be prepared according to the requirements of the Air Convention.

As this new air port will be placed under the control of the Imperial Japanese Aviation Bureau, it would become an important military organ in time of war. In time of peace, however, it will be a welcome training ground for civil aviators, who have long felt the necessity of such a ground.

Commercial Aviation in Morocco

In the Report, dated May, 1921, on the Trade, Industry and Finance of Morocco, issued by the Department of Overseas Trade, is the following reference to Commercial Aviation: The State-subsidized aerial, mail and passenger service, established in 1919 by the Compagnie Latécoère between Toulouse and Rabat, the administrative capital of the French Zone, was extended in 1920 to Casablanca, whilst the service was increased from eight flights a month to four a week, and will soon be made a daily one. The service has worked with most commendable regularity, and it is a great boon to business men to be able to travel from Casablanca to Paris in forty-eight hours. The route followed on leaving Casablanca is Rabat, Malaga, Alicante, Barcelona, and Toulouse, which latter is reached on the afternoon of the day following the departure from Casablanca, in time to catch the evening express to Paris.

The passenger fare is about fr. 1,600 for the full flight from Casablanca to Toulouse, whilst letters pay a surtax of 1.25 francs.

The First Naval Air Unit of the British Overseas Dominions

To Australia belongs the distinction of being the first among the British Overseas Dominions to establish definitely a Naval Air Service. It has been known for some time in the Aircraft Industry that the Australian Government had placed a quite considerable order for seaplanes with the Fairey Aviation Company Ltd., of Hayes. The first half-squadron of these is now ready for delivery, and the first machine of the Unit, which is very properly numbered A.N.A.1 (Australian Naval Aircraft 1) is to be launched on Saturday next from the Fairey Company's works at Hamble, on Southampton Water.

The machine will be launched by the Australian Prime Minister, the Right Honorable W. M. Hughes, and our old friend General Seely, who is Member for the constituency in which Hamble is situated, will preside at the inaugural luncheon given by the firm in conjunction with Rolls-Royce Ltd., with whose engines the first Australian Naval Aircraft are fitted.

Aviation in Italy

A group of fifty Representatives has been created in the Italian House of Representatives that has called itself the *"Group of Aeronautics."*

The President of the group is Hon. Turati, the well known Socialist leader; the Secretary is Hon. Finzi, the gallant pilot who took part in the raid on Vienna during the war.

The group will study and develop all aeronautical questions, but its most important work will be the organization of commercial aeronautics and international aerial navigation.

In the meetings they have considered the bills to be approved by the House concerning aeronautics and the ratification of the International Convention of Aerial Navigation.

Hon. *Gasparetto,* who was one of the most active members of the group, is now Secretary of War and this will signify a great improvement in civil and military aviation in Italy.

Second Prague Exposition

The second annual International Aircraft Exposition will be held in the Palace of Industry, Prague, from October 22nd to 30th. The exhibition will be under the patronage of President T. G. Masaryk.

Aeroplanes, balloons, airships and engines, together with parts and materials for their construction, as well as the apparatuses, tools and other articles used in aircraft manufacture will be exhibited.

The great success which attended the First International Exhibition in Prague, 1920, has encouraged the Club to arrange yearly exhibitions, and has assured it that all firms interested in aeronautics will take advantage of the opportunity this offered for them to show their products.

Up to now there is a regular air-service between Paris-Prague-Warsaw, and in a short time a similar service is to be opened between Berlin-Prague-Vienna.

Prague is geographically the chief point in Central Europe as well as the center of all Slave commerce and therefore will certainly hold the leading position in aeronautics.

At the conclusion of the exhibition a special festival will be arranged in order to give exhibiting firms an opportunity of showing, in a practical manner, viz.: flying, the qualities of their machines. This will be arranged for the 6th of November.

British Airman's Exploits in Spain

The exploits of Major de Havilland, the well-known "Bristol" aeroplane pilot, are sharing public attention in Spain with the Moroccan operations. Immediately upon the outbreak of hostilities an enterprising journal of Madrid, *"La Libertad,"* immediately obtained the use of a "Bristol" Tourer under the pilotage of Major de Havilland, and despatched their war correspondent to the scene of operations. After a lengthy flight the machine reached the aerodrome upon which they intended to alight, only to find the whole place occupied by the enemy.

Flying ten feet from the ground the "Bristol" pilot circled around their positions scattering the enemy in all directions and then, after a further flight of 120 miles across the sea, landed safely in Almeria. Next morning the machine was back in Madrid and the correspondent was able to bring off the biggest news "scoop" of its kind in Spanish history. The distance covered in twenty-four hours was probably in the neighborhood of 1,000 miles. The present-day position of Major de Havilland, feted on all sides with true Latin fervor, is not without embarrassment for the Englishman who declares that he heartily wishes he was back in Africa.

Lieut. Parer Abandons Australian Flight

In his proposed flight from Melbourne on a 10,000-mile flight round Australia, Lieut. Parer did not, unfortunately, get very far. He started on August 3 from Melbourne, in a gale, and about 40 miles out he ran into a blinding snowstorm. As his engine was running badly, he determined to descend. Having landed safely, he was standing near his machine, when a blast of wind tilted the machine and threw him against the whirling blades. His collar-bone was fractured, and he received injuries to his leg and toes. He is now in hospital.

Advertising German Air Mail Services

The Stuttgart postal authorities have recently brought in a new regulation as a means of propaganda for the Stuttgart-Constance-Switzerland air mail service. Between June 15 and July 30 letters were carried by way of experiment on the route in question at the ordinary postal fees, the usual additional air mail fee not being required.

The service was carried out in such a way that express matter received precedence over other matter for transport by aircraft. Bundles of printed matter and newspapers and other cumbersome postal matter, with the exception of express matter, were ruled out.

Two-thirds of the mail in question was forwarded by air, and one-third was held back and despatched in the usual way. By this means the Stuttgart postal authorities hoped to bring home to the public, who are in the habit of sending their mail by the usual channels, the advantages of the air mail service. The usual air mail matter—that for which the additional air mail fee has been paid—naturally received precedence over other matter.

The Schneider Cup Race at Venice

From being a keenly-contested event, the annual race for the Schneider Cup seems to have degenerated into a sort of one-man show, in which no one takes any particular interest. In the years before the War one could always be certain of seeing representatives of at least three countries at the seaplane race of the year. Now the entries are few and far between, and often those which do turn up manage to get deleted in the preliminary tests. In a great measure this country must be held responsible for this state of affairs, not by any sins of commission (unless one so classes the unfortunate affair at Bournemouth in 1919), but rather by sins of omission, by refraining from sending any representatives to the race last year, and again this year. This is all the more regrettable, as this country has all the requirements for becoming the world's leading seaplane power. Our seaplanes are second to none, but we do not seem to realize their possibilities in the development of commercial aviation. It is true that the Schneider Race is a speed event, pure and simple, but even so the lessons learned and the experience gained would be invaluable to the designer of commerical types. The present state of the country's finances is mainly to blame, but we cannot help thinking that with a little good-will the Royal Aero Club and the S. B. A. C. between them ought to have been able to send representatives to Venice this year.

Last year the raee was a walk-over for Italy, there being no foreign competitors for the Cup, which was won by Bologna on a Savoia. This year one French competitor was entered—Sadi Lecointe, on a Nieuport with 300 h.p. Hispano engine; but we regret to learn that he had bad luck in alighting after a test flight, damaging his undercarriage to such an extent as to preclude his taking part in the race.

The question now arises whether or not Italy is to retain the Cup. By the rules of the competition the country which has won the cup three times in five years has the right to retain it. After the lamentable affair at Bournemouth in 1919 it was at first stated that Janello on the Savoia had failed to round one of the mark boats properly, but ultimately it was decided to give the Italian Aero Club the custody of the Cup, and to hold the next race in Italy, under the organization of the Italian Aero Club.

If Janello is declared to have won the 1919 race properly—as we think he ought to be if there was sufficient doubt in the minds of the Royal Aero Club officials to let the Cup and the race for the following year go to Italy—it would appear that Italy becomes the permanent holder of the Schneider Cup—in which case we shall probably have to write *finis* to the annual Schneider races.

Perhaps in that case some other public-spirited sportsman may be found to present a new Cup.

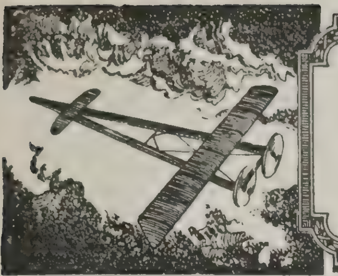
As regards the Schneider race this year, Sadi Lecointe was the only foreign competitor entered. As we have already said, he had the misfortune to crash his undercarriage (it does not appear to have been the floats themselves in this case) after a test flight. This left only the three Italian competitors. It is of interest to note that no less than ten Italian machines had been entered for the race. The eliminating trials left three competitors for the actual race. These were:

Briganti on a Macchi flying boat, type VII, with 200 h.p. six-cylindered Isotta engine. This machine has an aera of 215 sq. ft.

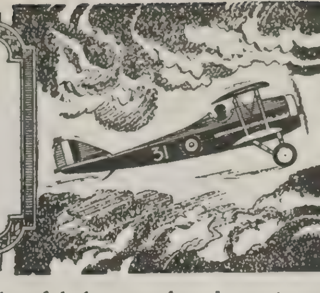
Zanetti was flying a considerably larger machine, viz., a Macchi, type XIX, with a 12-cylindered Fiat engine of 700 h.p., with a wing aera of 485 sq. ft.

Corniglio was flying one of the Naval flying boats with 250 h.p. Isotta engine and a wing aera of 290 sq. ft.

In the actual race two of the competitors dropped out. Zanetti's machine caught fire, but happily he and his mechanic were rescued. Corniglio ran out of petrol and had to abandon the race. This left only Briganti on the smallest machine, who completed the course at the average speed of 119 m.p.h.



ELEMENTARY AERONAUTICS *and* MODEL NOTES



Plans for Building Compressed-Air Model

MORE complete details are given herewith to supplement the notes and photograph of the Fastje compressed-air driven monoplane model which appeared in the July 11th issue.

This model, designed by Mr. Carl H. Fastje, of Dennison, Iowa, has a five-foot wing span and a nine-inch chord. The power plant is a two-cylinder opposed, having a five-eighth inch bore and a five-eighth inch stroke. The streamline compressed-air tank has safety and inlet valves at the front end. The tank is twenty-six inches long, 2¾ inches in diameter at the front end, tapering in a straight line to 1¾ inches near the end, where a streamline finishing cap is located. The motor specified is one obtainable from the Wading River Manufacturing Company; the tank may be obtained from the Model Machine Shop Company, 415 East 71st Street, New York City. Blue prints of the model drawn at a scale four inches to the foot, together with full sized details of all the principal parts, can be obtained from Mr. Fastje at moderate cost. The drawing shown below gives a general idea of the proportions of the model; it was drawn up by Mr. Fastje especially for publication in AERIAL AGE. It is interesting to compare the drawing of the plan view with the photograph previously shown.

Main Planes

Spars are of ¼" round white pine or similar wood. Ribs are made of balsa wood ⅛" thick or they can be made of white pine 1/16" thick. The wing section used is the U. S. A. No. 5. The method employed in making the ribs from balsa wood is to draw the wing curve on a block of balsa wood marking the positions of the spars and leading edge. The holes for the spars and leading edge are then drilled out absolutely perpendicular to the face of the block of wood. The block is then sawn out to the wing curve on a band saw. Then the wing curve lock is passed through a circular saw, making each rib ⅛" thick and exactly alike. Each wing exactly 28½" long.

The leading edge is made of 3/32" round split bamboo. Ribs are slipped on to the spars and glued in their proper places. The leading edge is secured to the ribs by drilling a 1/32" hole in the rib about ⅜" from front end and tieing with thread by passing it through the hole with a fine needle. The scalloped trailing edge is made by using No. 34 tinned wire. Rear ends of ribs are wrapped with fine thread, then a hole is drilled through with a number 61 drill, and a fine slit made in the end of the rib in which the wire fits. The wire is then secured with thread and glued.

A cross brace should be inserted between the two inner ribs so that the trailing edge wire will not bend the ribs when it is fastened on and also when the silk covering is doped and varnished. The covering is the best Japanese silk, doped and finished with bamboo varnish.

Tail Planes

The tail planes are constructed in similar manner as the main planes, with double cambered ribs. The rudder is made to fit into two ribs of the stabilizer plane, which holds it fast. The spars are 5/32" round wood and the ribs are made of balsa wood in the same manner as the main plane ribs are made and are 3/32" thick, and the leading edge is made of 1/16" round bamboo. The cross-braces between the ribs are also made of balsa wood and must not be omitted or the wings will warp badly out of shape when the silk covering is varnished.

Fuselage

Longerons are of ½ x ¼ inch white pine or spruce. They taper to a ¼" square at the rear end from the midway point. The longerons are exactly 42" in length. They are parallel to each other from the front ends to the front end of the tank. The tank is secured to the longerons according to the detail view in the drawings. The motor can be of any kind, but the two-cylinder opposed motor as drawn is secured by two strips of sheet aluminum passed over the cylinders and bolted to the longerons. The cabane struts are ⅛" round aluminum rod.

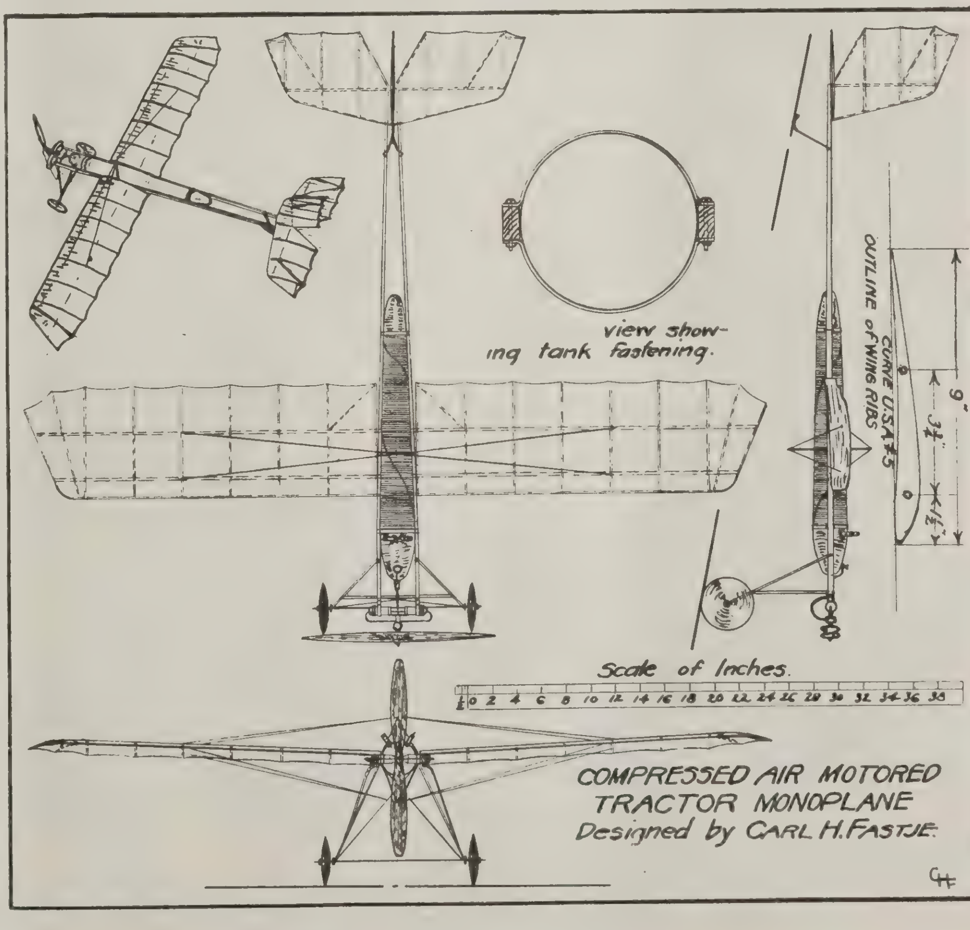
Landing Gear and Tail Skid

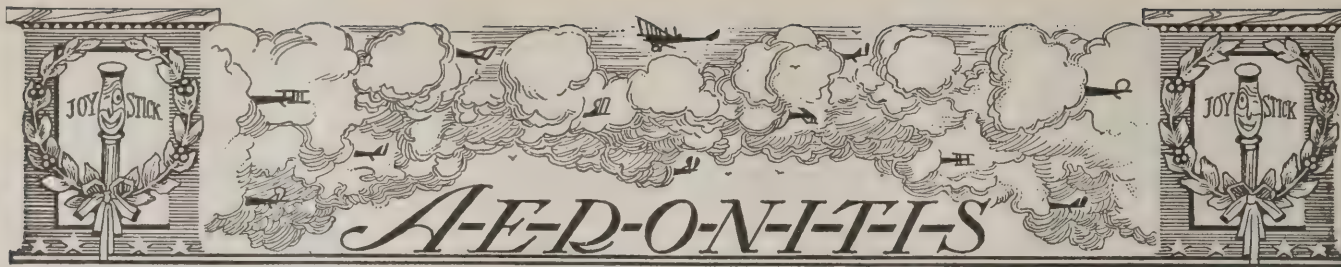
The landing gear struts are made of split bamboo ¼" wide and ⅛" thick, streamlined. The axle is ⅛" diameter aluminum rod. Wheels are made of balsa wood 4" in diameter, well streamlined. A piece of ⅛" inside diameter brass tube is used for the hub and is secured to the wheel by soldering a brass washer to it on each side of the wheel.

The tail skid is made of 3/16" x 3/32" split bamboo, streamlined. It is split for half the length and bent open to permit it to be attached to the longerons by thread and glue.

Propeller

The propeller should be from 14 to 16 inches in diameter and of rather low pitch. The best size can be found by experiment. The main plane and landing gear bracing wires are 26 gage brass.





The Lovely Comrade

(Miss Laura Bromwell, who was killed by a fall from her aeroplane on June 5, 1921, was known among her fellow aviators as the "Lovely Comrade.")

Above the flatness of the sunburnt field
In her swift plane her untaught hands grew tired;
She dared the upper spaces and with us
Conquered them, side by side.

And always for the merry, fearless heart
Her flyer's well-worn leather coat concealed,
We came to love her better every day,—
Our Lovely Comrade of the flying field.

On joyful wing cleaving the high, bright air,
No more her speeding plane goes venturing;
She has outsoared us in her dream of flight,
She has outstripped us in her piloting.

Yet still above the level, stretching field
We challenge as of old the gods of Space,
And seem beside us as of old to see
Our Lovely Comrade's merry, laughing face.

—*By a Fellow-Aviator.*

Tennessee—May Ah see you-all home?
New Jersey—You're drunk, man, there's only one of me.
—*Punch Bowl.*

Here It Is—There It Isn't

She: Jack is in love with you.
Her: Nonsense!
She: That's what I said when I heard it.
Her: How dared you!—*Cornell Widow.*

The Apple of His Eye

A peach came walking down the street;
She was more than passing fair;
A smile, a nod, a half-closed eye,
And the peach became a pair.
—*Cornell Widow.*

Financially Educated

"What did your son learn at college?"

"Well, sir, he can ask for money in such a way that it seems like an honor to give it to him."—*Virginia Reel.*

Why He Had It

Gob: Say, Doc, I have sores all over my feet, and mouth is sore too. What is it?

Doc: Let me see. Oh, yes! It's a bad case of the hoof and mouth disease.

Gob: Why, I thought only cattle were affected with that!

Doc: Sure; but you've been throwing the bull so much, you contracted it.

So Playful

"A man on first and third," said he,
"Here's where we work the squeeze."
"Oh, Charlie, dear, not right out here,
It is so public, please!" —*Proofs.*

Page Sherlock Holmes

Customer: "Waiter, I don't understand about this trouser button being in my soup."

Waiter: "I don't either, sir. We employ only women in the kitchen, sir." —*London Mail.*

Scene: Aeroplane hangar, Irish mechanic busily engaged in shaping a spar with a jack knife.

Asst. Foreman: "Why don't you try (i) plane?"

I. M.: "I haven't got ere a plane."

A. F.: "Well, buy (i) plane."

Foreman: "For the love of Mike, lend the mon a plane."

A Clean Joke

"May I hold your Palm, Olive?"
"Not on your life, Buoy!" —*Ex.*

He Was Wrong

"I don't believe the negro race is naturally eloquent," remarked the northern visitor.

"Sir," replied the old-fashioned southern gentleman, "you have probably never heard a colored bootblack addressing a few appropriate remarks to a pair of dice."

—*Birmingham Age Herald.*

The Officer's Mistake

Officer-in-charge of Rifle Range: "Don't you know any better than to point an empty gun at me?"

Raw Rookie: "But it ain't empty, sir; it's loaded."

—*The Mirror.*

Officer (drilling recruits): "Hey, you, in case of fire, what do you do?"

Recruit: "I yell."

"Yell what?"

"Why, what do you suppose? Cease firing!"

—*Le Rire (Paris).*

Had a "Miss"

Coxswain of 1st Motor Boat: "Have you a little fairy in your home?"

Engineer of 1st Motor Boat: "No, but I have a little miss in my engine."

The Way You Say It

Yeoman: "I was shot in the wrist."

B. M.: "Did it wound your wrist?"

Yeoman: "No, you simp, it wound my wrist watch."

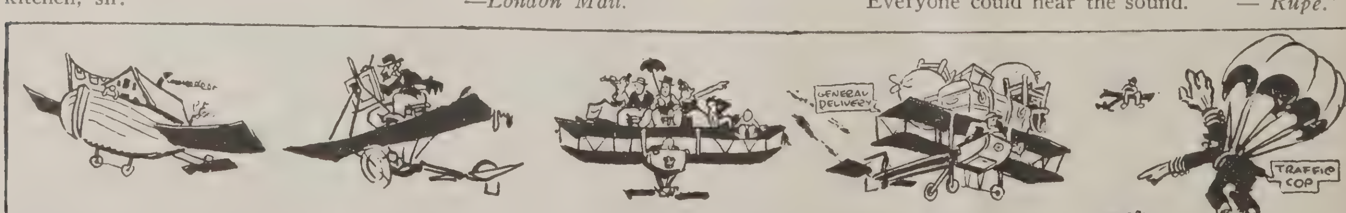
—*Phillips.*

Landing

By George J. Gould

I had a girl named Josephine,
We took a ride in my air machine,
We climbed up, five thousand high,
Until she thought she'd reach the sky.
Sailing along at a hundred per,
She winked at me and I at her.
All of a sudden something smashed!
Then I heard an awful crash!
When I came to my senses,
I was wrapped around barbed wire fences.
Then I looked around to see,
Where she landed in a tree.
When at last she reached the ground,
And found she was all safe and sound,
She hauled off and knocked me flat,
And she told me she wouldn't play if we had to land like that.

"We went up on high,
In a J. N., we fly
And when we came down
Everyone could hear the sound." —*"Rupe."*



When aeroplanes become so common that they do not bother the man with a boil on the back of his neck

AERIAL AGE WEEKLY

VOL. 13, No. 26 SEPTEMBER 5, 1921 10 CENTS A COPY

© Underwood & Underwood

The Loening Monoplane Flying Boat Establishing an Altitude Record of 19,500 Feet

The Dirigible Disaster

PUBLISHED WEEKLY BY THE AERIAL AGE COMPANY, INC., FOSTER BUILDING, MADISON AVENUE AND FORTIETH STREET, NEW YORK CITY
Subscriptions: Domestic, $4; Foreign, $6. Entered as second-class matter, March 25, 1915, at the Post Office at New York under the Act of March 3rd, 1879

G. DOUGLAS WARDROP
Editor

B. C. BOULTON
Contributing Technical Editor

G. F. McLAUGHLIN
Contributing Technical Editor

NORMAN E. JENNETT
Art Editor

H. B. CHILDS
Advertising Manager

AERIAL AGE WEEKLY

Member of Audit Bureau of Circulations; Chamber of Commerce of the United States; Merchants Association of New York; N. Y. Business Publishers Association; American Chamber of Commerce in London; National Safety Council; Broadway Association.

THE NATIONAL TECHNICAL, ENGINEERING AND TRADE AUTHORITY

With which is consolidated

Flying

PUBLISHED WEEKLY BY THE AERIAL AGE CO., Foster Building, Madison Avenue and Fortieth Street, New York City

Entered as Second-Class Matter, March 25, 1915, at the Post Office at New York, N. Y., under the Act of March 3, 1879.

Subscription Price, $4.00 a year, Foreign, $6.00. Telephone, Murray Hill 7489

VOL. XIII NEW YORK, SEPTEMBER 5, 1921 NO. 26

The Dirigible Disaster

THE destruction of the ZR-2 came at a time when the outlook for flying was exceptionally bright. Army and navy officials in the United States had taken a new attitude toward it. Experiments looking toward radio-driven torpedoes, controlled from the air, had been announced. The Gallaudet triple-motor drive promised much. Finally the casual message of the ZR-2 itself, flashed to its station by radio, that the weather might be better for landing in the morning and they would stay up for the night, had indicated the remarkable control men had achieved over the air and the comfortable feeling of an airship crew toward it.

Immediately upon these developments came the supposed buckling of the gigantic frame, the explosion, the death of forty-three men, and the total loss of the $2,000,000 dirigible built by England for the United States. Sixteen Americans perished, and Commander Maitland, the dominating personality in the field of lighter-than-air navigation in Great Britain, is among the twenty-seven British who died with them.

There have been questions asked as to why the United States was buying a dirigible from England, or why she wanted one at all. There have been hinted criticisms of the design, the soundness of construction, the wisdom of attempting the flight without further factory tests. All these have arisen in the excitement of the moment; some have point and some have none.

The airship is a part of naval equipment which no modern nation can neglect. The Zeppelins were not, on the whole, a success, but lighter-than-air craft constitute a potential aerial strength which the United States could not overlook.

Great Britain had experience and facilities which we had not, and Washington was wise in getting a sample of the work which had sent the first airship across the Atlantic. As to design and construction, we shall get little true news. The international aspect of the affair will work against frank expression of opinion by Americans, and the British will be on the defensive.

It seems certain, of course, that more factory tests should precede long flights, and that an economical non-inflammable gas like helium should be developed as rapidly as possible.

But post-mortems cannot undo the most terrible and costly accident in the history of aviation. Neither should they affect our view of aeronautics. This is no occasion for condemning the airship as a type, or condemning flying as too dangerous for humanity.

The principles of lighter-than-air craft and of flying in general are sound. The ultimate rewards offered by mastery of the air will continue to urge us on toward such a mastery. The accident is our penalty for ignorance, and it will not keep us from pushing on toward knowledge. The world, whatever it says at the moment of its grief, understands this pretty well. It can do no more for its dead than give them honor and redouble its effort to reduce the penalty for progress which the world has always paid and will probably continue to pay for many to-morrows.

Air Laws

SEVERAL committees of the American Bar Association are working at Cincinnati upon the drafts of acts looking to federal control of aircraft and aviation. It is promised that some action will be taken by the annual convention and that the recommendations of the convention will be pressed upon the attention of Congress.

This is the most promising talk heard as yet upon the question of air laws. The problem has been discussed in a general way. Cities and states have proposed a considerable local legislation, some of which has been put into effect. There has been no federal control. As the law of the United States stands at present anyone can buy whatever 'plane he wishes and use his own judgment as to flying it. If he is willing to risk his own life, that of his friends, or even the lives of hundreds of patrons, no one is authorized to forbid him.

This condition of affairs has persisted during a period of considerable aerial development. Air routes have been established—every night a passenger-carrying flying boat comes from Atlantic City and fares up the North River—demonstration flights are common, and there are a number of individuals and clubs owning and flying machines.

Canada has regulated air traffic within her borders. We in the meantime sit by while the 1917 army 'planes wear out, taking their toll of human life in the moment of collapse. The chief voices raised in favor of regulation are, paradoxically, the voices of those who manufacture or operate aircraft. They are asking for the inspection of machines and for rules on flying altitude, stunts, paths of flight, and landing.

The News of the Week

Dinner to Gordon Bennett Pilots

The Aero Club of America gave a farewell dinner in the garden of the American Committee for Devastated France, adjoining the Club House, to The American Team who are going over to Belgium to compete in the International Gordon Bennett Balloon Cup Race to be held in Brussels, on September 18th, on Friday evening, August 26th.

The members of the American Team who have been selected to represent America are Ralph Upson, winner of the National Championship Balloon Race and his aide, C. G. Andrus of the United States Weather Bureau; The Akron Chamber of Commerce is sending Mr. Ward T. Van Orman, in charge of the Airship Construction Division of the Goodyear Tire and Rubber Co., with Mr. Willard B. Seiberling as his aide. Mr. Bernard Von Hoffman and Mr. J. S. McKibben as aide, represent St. Louis.

This classic of the air has been won four times by America and was captured by the representatives of Belgium in the International Balloon Race held last October from Birmingham, Alabama.

Representatives from America, England, France, Belgium, Italy, Spain and Switzerland, will compete in this race.

This handsome trophy was put up by Mr. James Gordon Bennett for International competition and is considered the championship sporting classic of the air. The American Team has the best chance to win this year and has every confidence that they will bring back this handsome trophy to resume its place of honor in the trophy room of the Aero Club of America.

Urge Uniform Law For Aero Control

Passage of an amendment to the Federal Constitution as the proper basis for aviation control was recommended in a report by a special committee of the American Bar Association made public August 24.

The report challenges the proposition that it is an invasion of the rights of private ownership of property to utilize air for purposes of flight.

"It appears to be the unanimous judgment of those practically interested in the development of the art of flying," the report said, "that the demands of progress are for a uniform law operative throughout the country. If complete control is to be lodged in the National Government, the power should be conferred by constitutional amendment and should not be seized in the guise of the exercise of existing powers."

Kansas Air Meet

The First Educational Air Meet of Kansas will be held at Wichita, Kansas, on September 15, 16, 17.

This meet promises to be the biggest that has been held west of the Mississippi.

From the way the business men have responded to this event $5,000.00 will be available in cash prizes.

Already the entire list of entrants, who participated in the Colorado Aero Club's meet, have signified their intention of entering.

There will be events for all types of planes. Special effort is being made to have a number of high speed machines participate in the Aerial Derby.

All aviators desiring to enter, should address their entries to Air Meet Committee, Lassen Hotel, Wichita, Kansas.

The Concordia Meet

A three day aviation tourney in which fourteen aeroplanes participated was held at Concordia, Kan., August 11, 12 and 13. It was the first aeroplane meet in Northwestern Kansas and attracted aviators from Kansas, Colorado, Nebraska and Iowa. Twelve cups were given.

J. Hodgens Smith of Grand Island, Nebr., who has been a consistent winner in middle Western meets won a cup for acrobatics. The cup for cross country racing and spot landing was won by Errett Williams of Arkansas City, Kan., with his JN4D. Pat McCarthy, d-airdevil, won a cup for plane shifting and other stunts.

A feature of the meet was the first demonstration of a Kansas made commuters' plane made by the Longren Aircraft Corporation of Topeka. The plane has fold back wings permitting use of a motor garage as a hangar. It has a radial Anzani motor. The ship won the altitude contest.

The three day aviation tourney was attended by 15,000 from Kansas and Nebraska. A school of aeronautics was held in connections with the show. There were no accidents during the three days of stunt flying.

The Late Monte Rolfe

Monte Rolfe, one of the best known pilots in the United States, was killed in an aeroplane accident at Havana, Cuba on August 15. No details of the accident are available. Rolfe was born in England, whre he learned to fly. He had been in the United States since 1917, and had a very wide circle of friends. He was a skillful pilot, with an excellent record, and his death is a distinct loss to American aviation.

Washington Service to be Started

The Seaboard Consolidated Airlines of New York City announced August 22 the purchase of six Fokker limousine aeroplanes to be put in immediate service between New York and Washington. Each plane will carry six passengers and 1,000 pounds of baggage on a trip.

Officials of the line inspected one of the planes and made a flight over the city. The party consisted of Stanley Hubbard, President; Roy Pendleton, Secretary, and Homer C. Babcock and Charles M. Wilson, Directors. The initial flight of the new daily service, they said, would be made this week.

The Netherlands Aircraft Company, which manufactures the Fokker planes, announced that the six-passenger Half Moon would undertake to fly to Mexico City in three "hops," the stops being Chicago, Kansas City and El Paso.

National Guard Air Unit Almost Ready

The First National Guard Air Service Squadron in the United States is practically ready to start flying operations at Nashville, Tenn., according to information received by *The New York Times* in a statement from the commanding officer, Major John Caldwell Bennett, Jr. The project has been under way several months.

Interest in it was awakened in the Militia Bureau at Washington by the large possibilities of keeping alive the backbone of a National air service by organization of National Guard units, and in the War Department by the prospect of finding a ready and practical use for the huge surplus supplies of the air service.

The Nashville organization is designated in official records as the First Observation Squadron, Air Service, Tennessee National Guard. Headed by Major Bennett, who was a flight commander in the 139th Squadron, Second Pursuit Group, with headquarters at Souilly, France, during the war, the personnel of the squadron includes several officers, both pilots and observers, who saw service overseas, and officers who were flying instructors in the United States. The enlisted personnel also includes mechanics with actual Air Service experience.

After the preliminary organization had been perfected through an enlistment campaign, an inspection of the personnel was made last January by Major Henry V. Claggett, U. S. A., looking to Federal recognition of the unit so that equipment could be issued by the War Department. His report was understood to have been favorable, but recognition was held up for several months while the State and the War Department settled which should provide hangar facilities.

Provision for National Guard air service was made in a War Department circular letter in June, 1920. The letter specified that the State should provide landing field and hangar facilities and enlist the personnel, which the War Department would furnish all flying equipment. A field was leased by the State for six years, but "Uncle Alf" Taylor, Tennessee's Governor, balked at the hangars.

The problem was finally solved by the donation to the squadron of sufficient funds by the Commercial Club of Nashville to enable it to purchase hangar facilities. Then, says Major Bennett:

"Washington wired us that they would give us two hangars from Park Field, Memphis, but that we would have to pay to have them torn down and shipped to Nashville. We immediately accepted this offer and asked for shipping instructions. Last week I sent Lieutenant Charles G. Pearcy, our squadron adjutant, to Memphis to superintend the removal of the hangars. They will be standing on our field by the end of this week."

Meanwhile the personnel of the squadron had begun to lose interest and attendance at the ground school dropped off heavily. Letters were sent but did no good.

"Three weeks ago when we called the roll," said Major Bennett, "I told the men they had to be present from then on and I discharged every enlisted man who was absent that night. We had thirty-nine present and I discharged forty-two. Then we started a new enlistment campaign and brought our number up to sixty. Later I discharged one Captain, two First Lieutenants and five Second Lieutenants for non-attendance."

The provisional basis on which the Tennessee squadron is organized was outlined by the War Department to include eighty-one enlisted men, most of them non-commissioned officers, and twenty-two officers, including a medical officer. Ten service aeroplanes will be issued to the squadron by the War Department, together with machine shop transportation and all other equipment.

To the squadron will be attached, for instruction and observation purposes, two

officers and twelve enlisted men from the regular army Air Service.

War Department authorities are looking to the success of the Tennessee experiment to encourage organization of similar units all over the country. At present only one squadron to each army corps area is authorized, but if the movement should succeed it is probable that more would be authorized.

Steps have been taken in New York looking to the establishment of a National Guard squadron here, and Major Gen. John F. O'Ryan, in command of the New York National Guard, has kept in touch with the Tennessee unit's progress. So far, however, no definite arrangement has been made.

The Late Peter Cooper Hewitt

Peter Cooper Hewitt, the noted inventor, who was associated with the late Professor Francis B. Croker in his helicopter experiments, died in Paris August 25 as the result of an attack of pneumonia, following an operation.

N. Y.-Pacific Air Service Plans Not To Be Delayed

The plans for the commercial airway transportation service between this city and San Francisco, which is to be inaugurated in 1923 with gigantic airships, will not be delayed in any way by the ZR-2 disaster, it is authoritatively stated.

This service is backed by a group of capitalists of New York, Chicago, San Francisco and other cities, who have been in constant communication with the air service branches of the government. The initial capital involves $50,000,000.

The statement that the project would be pushed without delay was made by Fred S. Hardesty and Edward Schildhauer, the engineers representing the capitalists. They issued it in the offices of the Manufacturers' Aircraft Association, at 501 Fifth Avenue.

The airships to be placed in this service in 1923 will be built in this country, but will be fabricated from German duralumin. They will be approximately 30 per cent larger than the ZR-2, and will have a capacity of 200 passengers, besides crew and 50 000 pounds of freight.

According to the two engineers, they will make the flight from New York to Chicago in ten hours, and from coast to coast in less than thirty-six hours.

Dallas Aerial Police

New York is not the only city that can boast of an aerial police auxiliary. For Dallas, Texas, now has a trained group of flyers, holding special police commissions, who stand in readiness at all times to assist the regular force in emergencies where the speed of an aeroplane or its reconnoitering abilities are needed. All are volunteers.

Two of Dallas' "flying cops" were in Houston recently, having flown over on business, though not the "official" variety this article might indicate. One was Captain S. C. Coon of the Curtiss Aeroplane Company, and the other was H. M. McGraw, a commercial aviator who operates Viaduct Field. Both are keenly interested in the new aerial police corps and Captain Coon made arrangements for getting some wireless telephone equipment from the government.

"An aerial police auxiliary," Captain Coon stated, "is invaluable in time of strikes or riots and can be used to good advantage in reaching scenes of disasters and directing relief work. Aviation has become so general that the skies must be patrolled as well as the land. Our corps has been aiding materially in checking hazardous flying of all kinds over Dallas, such as 'stunting' at low altitudes and skimming the tops of buildings, thus reducing the element of danger to residents."

Aerial patrols, he said, would be of great value in dealing with auto banditry such as Dallas experienced during the recent "crime wave." Given the general direction in which the bandits fled, Captain Coon stated that a patrol of planes could soon determine whether or not they left the city, if not actually locate the fleeing car and report its location by wireless telephone. In either case, the information would be of great help to the police.

Captain Coon and Mr. McGraw left Dallas early in the afternoon and were in Houston in time for supper. With the wind at their backs, they expected to make the return trip in less than four hours and theirs was not a speedy "ship" as planes go!

Viaduct Field, which is operated by Mr. McGraw, is in the heart of Dallas, being located only half a mile from the Adolphus Hotel. It is one of the largest in Dallas and besides the usual passenger carrying and aerial photographic work, Mr. McGraw also conducts a school of flying.

Personal Par

Capt. Maurice A. Mott, the owner of the Compañia Nacional Aeronautica of Lima, Peru, the first commercial aviation company in that country, is again in the game, having made a number of interesting flights in both the S V A and the Curtiss Oriole. Capt. Mott had the misfortune of having his leg broken last August, being hit with the propeller, breaking the bone just above the knee in seven pieces.

Thurston Developing Cotton Fabric

Captain W. Harris Thurston, who was in charge of specifications, inspection and production of balloon and aircraft fabrics during the war, has returned to civil life as president of the W. Harris Thurston & Co., Inc., 116 Franklin Street, New York. This firm, in addition to the converting and commission merchandising of cotton fabrics, will make a specialty of mechanical cloths. Among the latter aeronautical fabrics will be a feature as Mr. Thurston intends to further develop this material. That he is well qualified in this capacity is recognized by all the large users of fabrics in this country as it was due to his untiring energy to a large extent that the present satisfactory cotton aeroplane cloth was developed. His experiments extended over a period of some ten years when linen was thought to be the only material that could ever meet the requirements of aeronautical cloth.

Canadian Notes

Halifax, N. S.—Travelling part of the way at a rate of over 100 miles an hour, the gigantic Canadian hydroplane, piloted by Colonel Robert O. Leckie, from Ottawa to Halifax, made the last leg of its journey from Fredericton, N. B., to the air station in two hours and a half. The whole flying time of the trip of eight hundred and forty miles from Ottawa to Halifax was approximately nine hours and forty-five minutes. It was a most successful and uneventful air voyage, according to the passengers who accompanied the colonel. These were: Col. J. S. Scott, O. C., Canadian Air Forces; Flight-Lieut. Walter R. Kenny, Flight-Officer E. R. Owen, and Warrant Officer W. C. Chapman.

The largest seaplane in Canada has been brought to Halifax to take part in the combined naval, military and air maneuvers next week.

A serious mishap in landing at Peace River occurred when a monoplane of the Imperial Oil Co. attemped to alight on the stream after completing a 1,100-mile flight from Simpson. No injuries were suffered by the crew or passengers, but the machine was badly wrecked and is almost completely submerged.

Captain Geo. W. Gorman with Mechanic W. J. Hill sitting with him and two passengers, Chester A. Bloom and Walter Johnson, were in the machine when the surface was struck. Instantly a rock on a hidden sand bar wrenched the right pontoon clear of the machine, and the impetus of the 90-mile-an-hour landing speed twirled the machine around and crumpled the left wing.

Roma Being Erected

The Roma, which recently arrived at Norfolk, is now being erected at Langley Field. The Roma is 416 feet in length and has a diameter of 82 feet. Her maximum speed is rated at 70 miles per hour, and she has a cruising radius of 1000 miles.

Night Flying Proves A Big Attraction

That air forces can destroy sea craft by night as easily as by day is the claim which the Provisional Air Brigade expects to establish as a fact in bombing exercises scheduled to take place some time in September. The U. S. S. Alabama has been designated as the target for the project.

Preparatory to the coming tests, the big work now being conducted by the Brigade is the training of bombing pilots in night flying. With the exception of Thursdays, Saturdays and Sundays, flying activities are carried on every night at Langley Field.

Regulations established by Brigade Headquarters for night flying are based on the general rules observed in daylight flying with special provisions to be observed in connection with problems encountered at night. A system of signals has been formulated whereby planes are directed to land and to take off, while code numbers assigned previous to the flight are used to identify the planes.

Distinguished Visitors Inspect Langley Field

Captain Katsuzo Kosuda, Inspector of the Ordnance Depot of the Imperial Japanese Army and Professor T. Tamjaru, who is the professor of Physics and member of the Aeronautical Research Institute of the Imperial University of Tokyo, Japan, were visitors at Langley Field last week.

Airship C-2 Makes Trip to Camp Meade

The C-2, which left for Camp Meade where it was engaged in daily flights and exhibitions before the Reserve Officers' Training Camp being conducted there, returned to Langley Field last week. Majors Fisher and Peek and Lts. Parris, Thompson and Holland, were included in the number making the trip.

A large number of Reserve Officers were taken on flights, over a hundred having requested this privilege, while the visit of the dirigible was made especially interesting for the camp when two of the airship's officers made parachute jumps from the big ship. Lts. Anderson and Thompson volunteered for this service, both men making excellent jumps before the large crowd of spectators.

The AIRCRAFT TRADE REVIEW

Wadsworth Introduces Federal Control Bill

Washington.—A bill for the governmental control and development of civil aviation was introduced August 24th by Senator Wadsworth. In explaining what it is proposed to accomplish by his measure, the Senator said:

"This bill provides for the control, regulation and development of civil aviation. In line with the recommendations made by President Harding in his inaugural message, it establishes a bureau of aeronautics in the Department of Commerce, thus providing commercial flying with a centralization already possessed by the Air Services of the army and navy.

"Through control, regulation and development civil aviation can make a real contribution to our transportation needs, and particularly in the carriage of mail, and at the same time provide an economical and indispensible reserve for the military and naval services.

"Already 1,200 commercial aircraft are in operation, but due to the lack of Federal control there were forty serious accidents in civil aviation the first six months of the year in which fourteen persons were killed and fifty-two injured.

"Of equal importance with the inspection and laying out of air routes is the establishment of terminals and the provision of means for disseminating weather reports and operating signals for aviators—all provided by this bill.

"This bill is also designed to correct a curious and extraordinary situation that is developing in customs and quarantine. Smuggling of persons and goods—including liquor—is easier by air than by many other methods, and contraband flying cannot be controlled except by special law with all the force of the Government behind it.

"This bill was prepared in response to the urgent solicitation of a score of organizations throughout the United States representing the operating, engineering, constructing, commercial and sporting elements in aviation. Its early enactment is imperative as a means of saving life and property, aiding our economic development and strengthening our national defense."

Parker Aircraft Company

The Parker Aircraft Co. has established headquarters at Perry, Iowa, where they have prepared a sales organization for Curtiss and Canuck parts.

The company has leased a substantial building and have complete facilities for rapid and careful work.

Diggins School News

Up to the end of August the Ralph C. Diggins Aviation School had graduated 65 pilots for the present season.

De Senn Chung, who graduated from the school last November, is now a major and chief instructor in the Chinese Air Service at Peking, China. He comments enthusiastically on the excellent training that he received at Chicago.

Chief instructor James Curran made over 2600 flights during the month of July, giving instructions and doing commercial work, rolling up a total of 216 hours flying time for this period.

Personal Paragraph

B. M. Spencer, formerly chief engineer of the Friesley Aircraft Corp., of Gridley, Cal., has severed his connection with that organization and expects shortly to associate himself with another California company.

New System of Determining Ground Speed of an Aeroplane in Flight

A mathematical system for determining the ground speed of an aeroplane during flight, as well as wind direction and velocity at any altitude, which shows considerable promise of proving an interesting and highly useful solution of these heretofore difficult problems in the longer cross-country, photographic, and bombing operations, has recently been evolved by Major Junius W. Jones, A. S., who has just completed a series of tests in these subjects incidental to his routine air missions as a student pilot at the Air Service Observation School, Post Field.

The system devolves upon the known geometric relationship between three factors, all of which may be readily determined by the pilot whilst in flight; namely, air speed, drift angle, and time each way between any two nearby points on the ground. An exact mathematical height above the earth, independent of the data given at the moment by the aneroid instrument, may also be determined by the system worked out by Major Jones, and would doubtless prove of great advantage over the altimeter, which is necessarily limited in accuracy by zero orientation at the home landing field, in cases where exact scale photography were to be carried out over distant objectives of varying elevation above the sea level, or when, in artillery work, the Battery Commander is requested to lay his guns on the plane, the exact altitude of the ship above the designated target forming the base line of triangulation by which accurate range may be determined.

To reduce the application of his system to a practical basis so that the pilot's attention need not be absorbed in calculation, which the inventor modestly admits must lead to realms somewhat abstruse before the integrations employed may be directly applied, Major Jones has resolved all formulae into a single simple chart, consisting of a series of arcs with their intersecting and correlated curves, a photostat copy of which has already been published in practical scale for use in the cockpit. By this chart it is necessary only for the pilot to adapt the simple arithmetical factors of time, airspeed and drift angle to a base line of the chart, which is then followed through its various intersections graphically to obtain the desired information concerning ground speed, wind direction and velocity, compass course, or altitude, etc.

Air Service Bids

Fire Box Heating Boiler—Engineering Division, Air Service, McCook Field, Dayton, Ohio.—Bids are wanted until 10 a. m. September 2, circular 2237, for furnishing 1 fire box heating boiler with down craft furnace, size sufficient to supply 10,000 feet radiation, 50 pounds working pressure. For information address above.

Pistons—Engineering Division. Air Service, McCook Field, Dayton, Ohio.—Bids are wanted until 10 a. m. September 9, circular 2238, for furnishing 150 pistons with oil relief groove. For information address the purchasing and contracting officer.

Engine Parts—Engineering Division, Air Service, McCook Field, Dayton, Ohio.—Bids are wanted until September 9, circular 2234, for furnishing miscellaneous parts for engine model W-2 as follows: 2 crank shaft bearings, 2 magneto drive gear bearing spacers, 2 oil thrower crank shafts, 2 tachometer drive shaft bearing spacers, 2 oil and water pump drive bearing spacers, 12 cam shaft drive shaft housing lower connections, 12 cam shaft drive shaft lower upper bearing cage, 2 magneto drive red gear shaft collar, 2 fuel pump driven shaft gears, 2 magneto spark control shaft bearing container nut pins, 2 fuel pump drive shafts, 2 magneto spark control shaft bearing containers, 8 magneto drive shaft bearing housings, 2 crank shaft gear bearing retainers, 2 crank shaft gear bearing retainer covers and 2 crank shaft gear centering sleeves. For information address above.

Engine Parts—Engineering Division, McCook Field, Dayton, Ohio.—Bids are wanted until 10 a. m. September 6, circular 2233, for furnishing parts for model W-2 engine, including 5 oil pressure line fittings, 5 do., 120-cylinder to crank case, clamp-nut lock washers, 120-cylinder to crank case clamp nuts, 120-cylinder to crank case nut lock washers, 120-cylinder to crank case nuts, 15-cylinder water inlet elbows, 75-cylinder water outlet connections, 8-cylinder water inlet tees and 100-cylinder water outlet cover plates. For information address the purchasing and contracting officer.

Cylinder Heads—Engineering Division, McCook Field, Dayton, Ohio.—Bids are wanted until 10 a. m. September 9, circular 2236, for furnishing 3 cylinder heads. For information address R. H. Fleet, purchasing and contracting officer.

Engine Parts—Engineering Division, Air Service, Dayton, Ohio.—Bids are wanted until 10 a. m. September 9, circular 2235, for furnishing parts for model W-2 engine, including 2 generator gear washers, 2 crankshaft gear nuts, 2 crank gear bearing retainers, 2 crank shaft thrust bearing nut screws, 12 cam shaft drive shaft upper nuts, 4 cam shaft drive shaft lower center nuts, 3 oil and water pump drive shaft nuts, 8 cam shaft bearing dowel shorts, 12 cam shaft drive shaft upper nut lock washers, 2 tachometer drive gear key washers, 2 magneto drive gear nuts, 8 cam shaft drive shaft lower nuts, 2 magneto spark control shaft bearing container nuts, 2 magneto spark control shaft collars, 2 magneto drive internal gear nuts and 2 fuel pump drive shaft collars. For information address R. H. Fleet, purchasing and contracting officer.

THE ZR-2 DISASTER

THE tragedy of the destruction of the ZR-2 in England occurred when hopes were highest that the great dirigible had at last satisfied all tests required before the ship was to be turned over to the United States Government. She had been out for thirty hours cruising in the North Sea and off shore, and her wireless told a story of good control and soundness of fabric. The ZR-2 was, in fact, about to come down to her shed when she was seen literally to contract and break asunder. There was a tremendous explosion of her tanks. The gigantic steel frame was wrecked, parts of it blown to fragments. Even after what remained of her fell into the Humber, the flames and smoke that rose into the air frustrated attempts to rescue any of her officers and crew who were alive.

As in all great tragedies of the sea and the air, there was in the loss of the ZR-2 a thrilling and outstanding display of heroism. The airship caught fire when she was directly over the center of this populous little city and while the entire population, with eyes strained upward, stood admiring her. Had she fallen in the city, the havoc there would have been horrible.

But Commander Wann, with the great airship cracking in two and with the flames creeping ever nearer the fourteen great bags filled with hydrogen gas, opened wide the throttles of the six great engines of the dirigible and hurled the crippled monster in the River Humber shallows, a scant 200 yards from the pier line.

Imprisoned in a burning gauzy bird cage a mile in the air and which in a few seconds was transformed into a veritable hell, the men aboard the airship had little chance to escape. Those who did escape leaped through the traps in the main floor of the car and by the use of parachutes, which were attached to each airman's shoulders, landed safely.

The heroic conduct of the commander is held here to be beyond all praise. When he was faced with the catastrophe he bravely steered the burning ship toward the river. If he had wavered or lost his presence of mind it would have descended on the old town and probably have practically laid it in ruins. Commander Wann accomplished a magnificent deed.

The tide rose rapidly after the fall of the airship and at dark every part of it was submerged.

The wreck of the ZR-2 was a terrifying scene. About 5:30 o'clock in the afternoon the airship, flying about 1,000 feet up, was first seen. She was sailing gracefully over the west central district of the city. The sky was beautiful and there was scarcely a vestige of a breeze. She was seen to shake and then her nose dipped. A puff of smoke arose from her bow. This was followed by a spurt of flame. Thousands looked aghast at the sight in the sky. Cries were heard:

"She has cut in two!"

This was true, but what had caused it it was impossible to imagine. A heavy mist seemed to hang about her. In fact, the atmosphere immediately became so hazy that the fire aboard the giant of the air was not the striking note of the spectacle.

Then six columns of smoke poured from the ship.

Women screamed. Both men and women rushed to shelter, behaving just as they did during Zeppelin raids on Hull in the world war.

It seemed that just before the explosion aboard the ZR-2 she turned in a southerly direction. No doubt the captain of the airship, realizing the danger, turned toward the Humber.

The Navy Department announced that official word had been received that six officers and eleven of the men of the non-commissioned personnel of the navy were on board the ZR-2 when the disaster took place.

The department gave out this list of officers figuring in the accident, with names of next of kin:

Officers

Commander Louis H. Maxfield, brother, A. C. Maxfield, 627 Goodrich Avenue, St. Paul, Minn.
Lieut. Commander Valentine N. Bieg, mother, Mrs. F. G. Bieg, 120 South Fairfax Street, Alexandria, Va.; wife, care of Mrs. Ronald Barlow, Haverford, Pa.
Lieut. Commander Emery Coil; wife was with him in England.
Lieutenant Charles G. Little, father, Henry B. Little, 227 High Street, Newburyport, Mass; body recovered.
Lieutenant Marcus H. Esterly, wife M. E. Esterly, 242 Auburndale Avenue, Youngstown, Ohio; body recovered.
Lieutenant Henry W. Hoyt, mother, Mrs. R. D. Hoyt, Clearwater, Fla.

Non-Commissioned

Charles I. Aller, father, H. L. Aller, 1200 Thirteenth Street, Denver, Col.
Maurice Lay, wife, Mabel R., 400 Eugent Street, Greensboro, N. C.
A. S. Pettit wife, Margaret H., 326 East Thirty-fifth Street, New York.
Robert M. Coons, mother, Kate, 812 Allen Street, Owensboro, Ky.
Lloyd E. Crowel, wife, Minnie, 26 Savage Street, Charleston, S. C.
J. T. Hancock, father, John, 17 Godwin Road, London, England.
William Julius, mother, Frieda J., 356 Seventy-seventh Street, Los Angeles, Cal.
Albert L. Loftin, father, James Benjamin, 710 Shattuck Street, Lake Charles, La.
William J. Steele, wife, Lena C., Bainbridge, Ind.
George Welch, sister, Elizabeth Kimmerman, 159 Valley Road, Montclair, N. J.

Five Millions Invested

When the blazing wreck of the ZR-2 dropped out of the air there was lost not only the biggest airship in the world and nearly all of her experienced crew, but an investment of about \$5,000,000. There will be saved for future use the immense hangar at Lakehurst, N. J., built especially for the ZR-2, and which cost \$2,000,000, but the cost of the ship, for which the navy was to have paid \$2,000,000, and the additional million spent for wages, transportation, trials and other expenses is a complete loss.

During her first trial trips, beginning on June 23, the ZR-2 developed a "hump." This was caused by the bending under strain of the supporting girders and latticework that kept the giant envelope in shape and held the understructure to it. Engine trouble also developed. On her first trip she remained aloft for forty-eight hours with forty-eight persons aboard, including Commander Maxfield.

Subjected to Severe Trials

With the strengthening of these girders and rods the tendency to buckle seemed to have disappeared. Nevertheless, the British builders refused to turn the airship over to the navy airmen until she had been subjected to severe trials, and even suggested a postponement of the day she was to start on the voyage to America, which was set for next Sunday.

The ZR-2, as the largest and latest experiment in aircraft building, represented all that was new in rigid dirigible balloons. The balloonettes, containing the hydrogen gas and filling the immense cigar-shaped envelope, were constructed after a new method that saved both money and material.

The British designed the ZR-2, or R-38 as she was named when planned, to be a dreadnought of the air, and the most formidable craft cruising between earth and sky. She was designed for a flight of 5,000 miles at her full speed of seventy miles an hour, or for 6.500 miles at a speed of ten miles an hour slower.

With her length of 695 feet, fifty feet over the R-34, the ZR-2, could she have been set on her nose and leaned against the Woolworth Tower, would have reached almost as far up as the gilded cupola. Her diameter was eighty-five feet. The innumerable balloonettes held 2,700,000 cubic feet of hydrogen gas, capable of lifting eighty-three tons of deadweight.

Fourteen Machine Guns Carried

The armament which this great airship carried suggests the bristling guns of a battleship. The specifications called for fourteen Lewis machine guns, and a one-pounder automatic. Her torpedo equipment called for four bombs weighting 520 pounds each, and eight bombs weighing 230 pounds each. The guns and bombs, placed at all of the vantage points from stem to stern, could be turned on attackers from land, sea or the surrounding air.

The lessons learned from the fate of the Zeppelins during the war were remembered in designing the ZR-2. To guard against the puncturing of her gasoline tanks by locating an unprotected spot and holding back the trigger of a machine gun until the stream of bullets found their mark, the ZR-2 had machine gun nests at the tip of her stern, one out toward her nose, and one in each of the four cars carrying the engines.

The one-pounder automatic was in a cockpit on top of the big envelope.

Four gondola cars hung from the envelope. Extending the length of the ship was a passage way bounded on both sides by a network of girders, guys, wires, gasoline and water tanks, valves, pipes and tubes in a confusion and conglomerate profusion that made a layman dizzy. Concentrated in the pilot house, within reach of the captain's hands, was the collected array of electric buttons, levers and switches by which the ship was operated.

Standing at his instrument board, the commanding officer would have been able to steer the ship to the right or left, or upward or downward, to drop a bomb, to release gas from any part of the envelope, to empty tanks of water ballast, to keep

himself informed of the workings of the ship from end to end, to signal any one of the engines, send a wireless message or control gunfire. A telephone system connected all parts of the craft.

Sleeping Quarters for Thirty

Sleeping quarters were provided for thirty officers and men, and food was heated by the exhaust from the engines passing through a special apparatus.

She was designed to take on supplies through pipes, so that by tying up to a mooring mast and connecting with the fuel supplies her tanks of gasoline, oil and water could be quickly filled and flight resumed.

The measurements of the ZR-2 were: Length, 695 feet; diameter, 85 feet 4 inches; capacity 2,700,000 cubic feet; lifting capacity, 83 tons; disposable lift, available for fuel, stores and other purposes, 50 tons; engines, six of 350 horsepower each, total 2,100 horsepower; endurance, 6,000 miles; maximum altitude possible, 25,000 feet. The ZR-2's nearest competitor was the R-34, that made the trip from England to America and back in 1919.

Huge Hangar Prepared

Awaiting the ZR-2 over here was a hangar of the same record-breaking proportions as herself, and 250 officers and men to take charge when she landed at Lakehurst.

Had the weather been fair the airship would have been moored to a steel harness attached to three big concrete blocks, laid out in a triangle. Fastened at the nose, the ZR-2 would have been able to float above the ground and meet wind from any direction. A steel mooring mast was under construction.

The hangar, intended for use in bad weather, is equipped with sliding doors so big that it takes the operating machinery ten to fifteen minutes to open them. A three-track railway runs through the hangar and out into the field for 1,500 feet at each end. Placed on a train of flatcars and secured with tackle, the ship would have been rolled under cover for protection.

With the gradual reduction in the time of crossing the Atlantic by the ships of sail and steam that followed Columbus for five hundred years, the most astonishing, coming within a few years, is that made by aircraft.

The ZR-2, in time of war, would have been equal to several scout cruisers. Her gas bags, filled with helium gas, would have been in no danger from fire. Helium is non-inflammable and almost as buoyant as hydrogen. The navy has a plant at Ft. Worth, Tex., where helium is extracted from the natural gas, the only plant of its kind in the country. It is in daily operation. There is now wasted at natural gas plants 100,000 cubic feet of helium that the navy could use in time of war.

Unlike the R-34, which crossed in 108 hours, 12 minutes, in July, 1919, the ZR-2 would not have had to nurse her fuel supply. She carried 2,900 gallons of gasoline more than did the R-34 and was capable of from ten to twenty-five miles an hour greater speed. She had six 350-horsepower motors, compared to the R-34's five of 250-horsepower.

The course plotted for the ZR-2 was from Howden, westward over Ireland and then west by south around the curve of a great circle to Newfoundland. She was then to cross New England and New York to Lakehurst.

ZR-2 Out of Date

A despatch from the Washington correspondent of the New York *World*, states: The ill-fated airship R-38 which carried to their deaths practically the whole American and British crew on its trial trip was of obsolete type and had structural weaknesses to which our flying men attribute the disaster.

Extraordinary as it may seem, these defects were known to both army and navy aviation men and formed the basis of adverse reports on file in the departments.

In the testimony there are passages that show the British knew the faults of the design as well as ourselves. The only explanation of the navy's ordering the airship in these circumstances was that it needed such a ship, and the R-38 was available.

Was Like 1914 Zeppelin

Denuded of the specification technicalities, the R-38 was merely a 1914 Zeppelin, into the middle of which had been sandwiched an extra section to make it longer. There were other defects which were pointed out by the American officer who inspected her in July, 1919, when the frames were being assembled and the making of the gondolas was practically complete.

"So," runs this officer's report, "the design can be said to be that of a 1914 Zeppelin, with increased lift obtained by the insertion of parallel sections in the design of previous ships."

This report was made while the ship was building. Accounts of the catastrophe agree that the R-38 broke in two amidships —just where the extra section was inserted in the design after the 1914 Zeppelin.

"This ship," the report continues, "is now obsolete for several reasons.

"Her basic design was patterned after an obsolete Zeppelin type. Another feature which in itself should have relegated the R-38 to the scrap heap was that her stabilizing surfaces were planned to be externally braced. All approved practice in the modern building of such ships requires internally braced fin surfaces built as an integral part of the ship.

"The aircraft section of the Allied Naval Commission, which visited the different air stations in Germany in December, 1918, commented on this phase in their confidential report, with which English and American naval officers are familiar. A modern ship would under no circumstances be built without internally braced fins for the reason that they do away with external bracing wires, which increase resistance and lessen speed.

"Internal construction strengthens both the fins and the hull, increasing safety thereby. They increase the manoeuvering power greatly. They tend to hold the ship to its course more truly. They permit passage inside the fins to the control surfaces, thus permitting repair or adjustment during flight."

Was Obsolete, Navy Knew

In another portion of the testimony one of the navy aviation authorities is quoted as stating that the navy realized the airship R-38 was obsolete when it bought the craft.

It is worth adding that Brig. Gen. Edward Maitland, who commanded the R-34 on her trip to America, was killed in the explosion of the British ship's sister craft, said when he had completed the first lighter-than-air transatlantic flight that the R-34 even then was "virtually obsolete."

The R-38 was designed and construction on her was started during the war—work on her was under way when the navy bargained for her.

The first English ships of the Zeppelin type, the R-33 and the R-34, were patterned after the Zeppelin L-33, brought down near Colchester, England, in 1916, and the Zeppelin L-49, brought down in France the same year. The first British ships, R-33 and R-34, were not completed until after the armistice. One expert, who had devoted years to studying the technical side of lighter-than-air craft, says:

"Without practical experience in rigid powers and limitations, the English went on producing larger ships by simply inserting parallel sections, which gave a greater lift only at the cost of considerable loss of speed."

Structural Defect, States Wann

Lieutenant A. A. Wann, who was in command of the American navy dirigible ZR-2 when it collapsed in mid-air Wednesday above Hull and plunged into the Humber River, with the loss of forty-four lives, said in a signed statement that the structural weakness of the ship had caused the disaster.

This declaration was made to the Hull police in connection with the official inquiry into the tragedy at the airdrome at Howden. As reported by the Hull correspondent of *The London Star* this evening, Wann's statement reads:

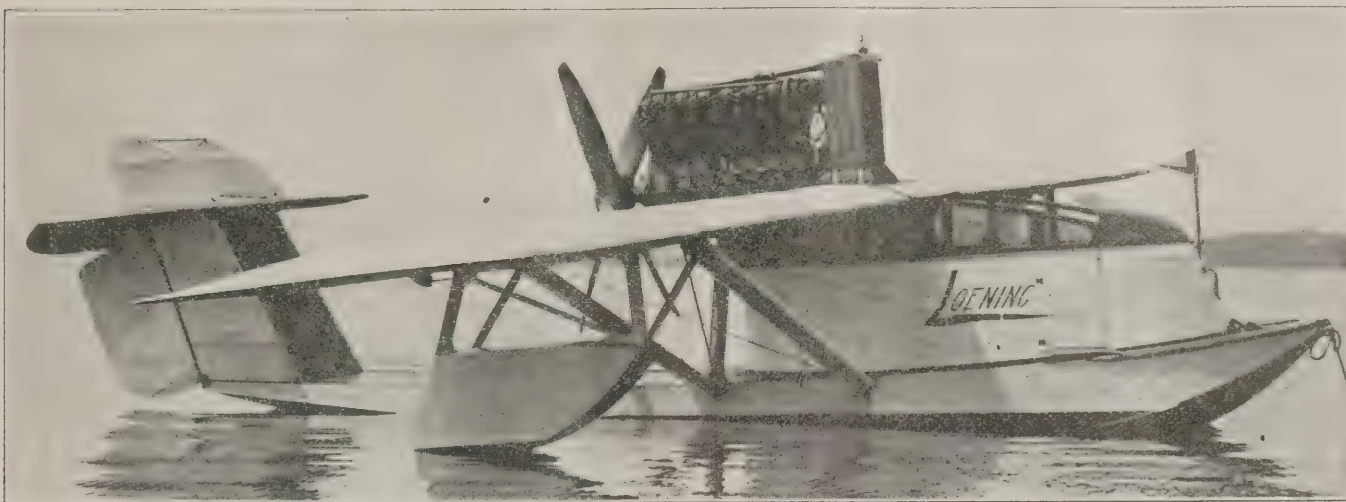
"I want to say that the accident was due to a weak structural part of the ship which broke in two pieces. I couldn't say which part it was. I had been flying for 36 hours when the mishap occurred and had intended to make this my last flight."

The Star correspondent says that Lieutenant Wann sent word to the police that he desired to make a statement regarding the disaster. Inspector Dont, accompanied by a constable, went to the hospital where Wann is, and took down the statement, which the flyer signed.

The fact that Lieutenant Wann was the only person in the front part of the balloon who survived—the other four who lived through the accident were in the stern—makes his testimony regarding the cause of the airship's collapse of particular importance of the investigation. The explosions occurred in the forepart of the craft.

The strictest secrecy is being maintained regarding the investigation at Howden. Newspaper men who went to the airdrome were requested to leave. Sir John Salmond, Vice-Marshal of the Air Ministry, presided at the inquiry and Commander Horace T. Dyer, U. S. N., appointed by the American naval attache to represent the Navy Department, and several other United States naval officers, attended the hearing by invitation from the Air Ministry.

Every facility was given the Americans to make the inquiry as complete and searching as possible. The testimony of the airship's designers and others acquainted with the details of its structure is being heard.



THE LOENING MONOPLANE FLYING BOAT

WE illustrate herewith the Loening monoplane flying boat, which, as we reported last week, established a new altitude record for hydro-aeroplanes on August 16 by reaching a height of 19,500 feet with pilot and three passengers. An even greater height could easily have been reached had it not been for the discomfort of the passengers, who were garbed in summer clothing.

From the illustrations it will be noted that the machine has some new features. The passenger cabin is built on top, not in, the hull. The wings and wing strut bracings, it will be noted, are similar to those on the recent Loening monoplanes developed for the U. S. Army.

The wing span is 43 feet, and length of hull 25 feet.

The weight light is 2200 pounds; the weight loaded, which includes pilot, four passengers and two hours fuel, is 3500 pounds.

The power plant is a Liberty motor (high compression) equipped with Bijur electric starter. Its speed is between 125 and 130 miles per hour.

One of the remarkable features of the boat is that it is every bit as manoeuverable as a land machine. It has a very rapid climb and gets off the water with the motor turning up 1100 r.p.m. It flies with the motor throttled down to 900 r.p.m.

Two views of the Loening Monoplane Flying Boat which recently established an altitude record for three passengers and pilot

REPORT OF JOINT ARMY AND NAVY BOARD ON BOMBING AND ORDNANCE TESTS

1. The Secretary of War and the Secretary of the Navy have approved the following report of the Joint Board on result of aviation and ordnance tests held during June and July, 1921.

Nature of Experiments and the Results

2. Certain ex-German war vessels having been turned over to the United States Government in accordance with the decision of the Supreme Council as to their allocation, the Navy Department decided to comply with the provision requiring their destruction by conducting a series of experiments in which these vessels were to be sunk by gunfire or by bombs dropped from aircraft. In order that both branches of the national defense might gain the maximum benefit the Secretary of the Navy invited the Army to participate in these experiments.

3. In addition to the experiments with the ex-German vessels as targets, one was conducted with the ex-Iowa steaming under radio control as a hypothetical enemy. Search was conducted by aircraft and attacks made using dummy bombs from 4,000 feet altitude. This experiment was conducted with a view to obtaining information as to the effectiveness of aircraft in search operations, the ability of aircraft to concentrate for effective attack on a vessel at sea, and the percentage of hits which could be made by dropping bombs from this altitude under the most favorable conditions against a slow moving target capable of changing course at will to decrease the accuracy of bombing.

4. The aviation experiments were successfully conducted under the direction of the Commander in Chief, Atlantic Fleet, by the Air Force of the Atlantic Fleet and a provisional Air Brigade of the Army. The gunfire experiments were conducted by destroyers and battleships of the Atlantic Fleet.

5. The experiments extended over the period from June 21st to July 21st, and resulted in the sinking of the ex-German vessels as indicated below:

Type	*How Sunk*	*Date*
Submarine U-117	Bombs	21 June
Submarine U-140	Gunfire	22 June
Submarine UB-48	Gunfire	22 June
Destroyer G-102	Bombs	13 July
Destroyer S-132	Gunfire	15 July
Destroyer V-43	Gunfire	15 July
Light Cruiser "FRANKFURT"	Bombs	18 July
Battleship "OSTFRIESLAND"	Bombs	21 July

6. The schedule of experiments was so arranged as to obtain the greatest amount of information for the practical development of aviation and ordnance including weapons, their appurtenances, and projectiles. Boards of Observers were appointed by the War and Navy Departments.

7. The experiments definitely determined in each case that the projectiles used were superior to the defensive features of construction of the vessel attacked. It has long been recognized that the gun carried by any type of war vessel is superior at moderate ranges to the armor or protective construction of vessels of like type. In a large measure, therefore, the greatest interest in these experiments lay in the bombing of naval vessels by aircraft. The main features of this report, therefore, relate to the effectiveness of aircraft in offensive action against various types of naval vessels.

8. The Joint Board has carefully studied the reports of the Boards of Observers and as a result of such study, actual observation of the experiments by one or more members of The Joint Board, and general knowledge of the principles of war and methods of conducting war, has arrived at the following general conclusions:

General Conclusions

9. Within their radius of action, which, relative to that of naval vessels, is extremely short the effectiveness of heavier-than-air craft carrying large capacity high explosive bombs, depends upon:

(a) Ability to locate the naval vessel,

(b) Ability to hit the target vessel with the projectile carried,

(c) Ability of the projectile to damage or destroy the vessel.

Consideration of Ability to Locate the Naval Vessel

10. Aircraft of any of the three general classes: lighter-than-air ships, flying boats and land planes, either in combination or singly, have pronounced ability to search sea areas within their radii of action and to locate naval vessels operating in such areas. The high speed of aircraft and the range of visibility obtained by altitude are factors which make these craft especially valuable in the Service of Information.

11. Heavier-than-air craft may obtain the maximum radius of action for use in the Service of Information only by carrying additional fuel in place of heavy bombs. When armed with heavy bombs the radius of action of heavier-than-air types is inadequate for extensive search operations. Therefore, to conduct an effective attack on naval vessels it will usually be necessary to have certain aircraft for searching and others for conducting the attack with bombs.

12. Darkness, fog, falling or squally weather, will greatly reduce the effectiveness of aircraft in search operations. Most of these conditions likewise adversely affect surface vesssls conducting such operations but not to the same extent.

13. The present dependability of the personnel and material of the Army and Navy aircraft appears to be such as to ensure that search operations, under suitable conditions, can be conducted without an undue percentage of loss. The further development of aircraft will undoubtedly increase both dependability and radius of action.

Ability to Hit the Target Vessel With the Projectile Carried

14. The number of dummy bombs which actually hit the target during the experiment with the ex-IOWA was a very small percentage of those dropped. Other experiments, however, showed that it is not necessary to make direct hits on naval vessels to put them out of action or to sink them, provided the bombs drop sufficiently close to the vessel and the explosive charge is sufficiently large to produce a mine effect of such proportions as to destroy the water-tight integrity of the vessel beyond the control of its personnel and pumps. The effective target for the bomb being, therefore, greater than the deck area of the target vessel, the percentage of effective bombs would be greater than the percentage of actual hits.

15. Inasmuch as these experiments were not conducted under battle conditions it is difficult to draw conclusions as to the probability of hitting a target with bombs from aircraft while in action. Under the favorable conditions existing during the experiments—namely, stationary, or practically stationary, target, immunity from enemy interference and excellent visibility and flying conditions, the percentage of hits was greatly in excess of that to be expected under battle conditions.

16. The probability of hitting will be reduced in the case of a target moving at high speed on varying courses; further reduced if the target vessel is protected by effective anti-aircraft armament; and practically negligible if the target is protected by effective pursuit planes. On the other hand the probability of hitting will be increased by more efficient sighting and bomb-dropping control apparatus, by further training and further development of aerial tactics.

17. In the present state of anti-craft defense it is believed that, if an air force can obtain the mastery of the air, an effective percentage of hits can be obtained against surface vessels coming within the radius of action of bombing planes without an undue percentage of loss of aircraft. Anti-aircraft armament is in an early stage of development. The history of war indicates that means of defense develops rapidly to meet the development of offensive weapons. The effectiveness of the bomb carried by aircraft emphasizes the necessity for the rapid development of anti-aircraft armament and for the provision of pursuit planes as a part of the fleet.

Ability of Aircraft to Damage Naval Vessels

18. Aircraft carrying high-capacity, high-explosive bombs of sufficient size have adequate offensive power to sink or seriously damage any naval vessel at present constructed, provided such projectiles can be placed in the water close alongside the vessel. Furthermore, it will be difficult, if not impossible, to build any type of vessel of sufficient strength to withstand the destructive force that can be obtained with the largest bombs that aeroplanes may be able to carry from shore bases or sheltered harbors.

19. High-capacity, high-explosive bombs hitting the upper works of the vessel are disastrous to exposed personnel, serious to light upper works, comparatively slight to heavy fittings such as guns, and negligible to turrets. The effect of direct hits was completely local. The most serious effect of bombs is the mining effect when such bombs explode close alongside and below the surface of the water.

20. In the case of major ships the mining effect of a bomb will be materially reduced due to the ability of the personnel to free the ship of large quantities of water by means of

pumps to distribute the excess water through the various compartments and to shore up the water-tight doors and bulkheads which are in most serious danger of carrying away due to water pressure.

21. Aircraft, through the medium of machine guns and fragmentation bombs as well as by high-explosive bombs of high capacity, possesses sufficient offensive power to seriously threaten the exposed personnel of naval vessels unless such vessels are protected by pursuit planes. This emphasizes the necessity for the further protection of personnel and for the provision of aircraft carriers on which such pursuit planes may be based.

22. The effect of the gas bomb has not been determined but it is believed that such bombs possess offensive power which, within the radius of action of the aircraft, is today a serious threat to vessels insufficiently protected by aircraft.

Summary of General Conclusions

23. At present aircraft possesses the following abilities as regards operations with the fleet in areas beyond the radius of action of aircraft based on shore:

(a) Limited assistance to gunnery in the control of fire.

(b) Limited assistance in the Service of Information and Security.

(c) Important strategical and tactical qualities in operations of coast defense.

In adequate quantities they may be the decisive factor in such operations. The availability of these qualities at present depends largely on weather conditions. The radius of action of bombing planes limits their effectiveness against naval vessels to coast defense, or base defense, in which this type is a very powerful adjunct to the present system of coast defense.

24. With reference to the effect of aircraft on future naval construction The Joint Board is of the opinion that:

(a) The mission of the Navy is to control vital lines of transportation upon the sea. If no opposition is met from enemy naval vessels this mission can be accomplished without entering an enemy's coast zone within which aircraft based on shore or in sheltered harbors are effective.

(b) Without an effective Navy in time of war a nation must submit to an economic blockade fatal to its trade and the importation of necessary materials for the production of war supplies.

(c) If heavier-than-air craft are to be effective in naval warfare they must have greater mobility and since their radius of action is not great, additional mobility must be obtained by providing mobile bases—i.e., aircraft carriers.

(d) So far as known, no planes large enough to carry a bomb effective against a major ship have been flown from or landed on an aeroplane carrier at sea. It is probable, however, that future development will make such operations practicable.

(e) Even in the present state of development the aircraft carrier, as exemplified by the *Argus* of the British Navy, is a type essential to the highest efficiency of the fleet.

(f) Aircraft carriers are subject to attack by vessels carrying guns, torpedoes or bombs and will require, as all other types of vessels require, the eventual support of the battleship.

(g) The battleship is still the backbone of the fleet and the bulwark of the nation's sea defense, and will so remain so long as the safe navigation of the sea for probable, however, that future development will make in war.

(h) The aeroplane like the submarine, destroyer and mine, has added to the dangers to which battleships are exposed but has not made the battleship obsolete. The battleship still remains the greatest factor of naval strength.

(i) The development of aircraft instead of furnishing an economical instrument of war leading to the abolition of the battleship has but added to the complexity of naval warfare.

(j) The aviation and ordnance experiments conducted with the ex-German vessels as targets have proved that it has become imperative as a matter of national defense to provide for the maximum possible development of aviation in both the Army and Navy. They have proved also the necessity for aircraft carriers of the maximum size and speed to supply our fleet with the offensive and defensive power which aircraft provide, within their radius of action, as an effective adjunct of the fleet. It is likewise essential that effective anti-aircraft armament be developed.

25. The Joint Board recommends that the provisions of the previous orders of the War and Navy Departments relative to secrecy concerning the results of the aviation and ordnance experiments be rescinded and that this report, if approved by the War and Navy Departments, be issued jointly to the press.

THE BARNHART TWIN NO. 15 "WAMPUS-KAT"

THE latest development in American, moderate sized, commercial transport aeroplanes is shown in the Barnhart Twin No. 15 "Wampus-Kat," a new product of the C. R. Little Aircraft Works of Pasadena, California.

Before the work of designing and constructing the machine was started, one year was spent in planning and investigating the need for a commercial aeroplane that would assist in establishing the commercial use of aircraft. Mr. G. Edw. Barnhart conducted this investigation and as a result incorporated into the design of Barnhart Twin No. 15, "Wampus-Kat," the features that would satisfy the needs of commercial aviation. Mr. L. G. Stern, who has over ten years' experience in aircraft construction, during which time he has held many responsible positions, is the shop superintendent, and personally supervised the construction of the "Wampus-Kat." The establishment and construction of the Barnhart Twin No. 15 "Wampus-Kat" was financed by Mr. C. R. Little, a retired business man, who has unlimited faith in the future of commercial aviation. Mr. Murray S. Elton is carrying on the expansion of the organization, sales and works.

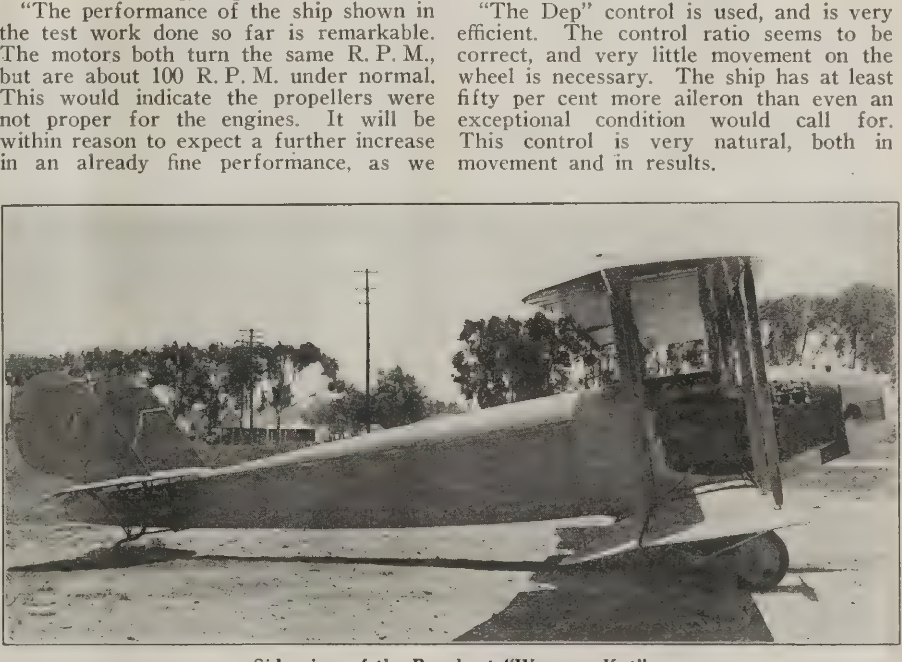
The unique christening of this new machine was held August 3, 1921, under the auspices of the Pasadena Chamber of Commerce, with the Tournament of Roses Association co-operating. While a small girl showered the machine with flowers, Mr. R. Short and Mr. Wally Timm, in a Barnhart machine, flew over and dropped quantities of flowers on the new machine.

A resumé of the report of the test pilot, Mr. G. G. Budwig, is given:

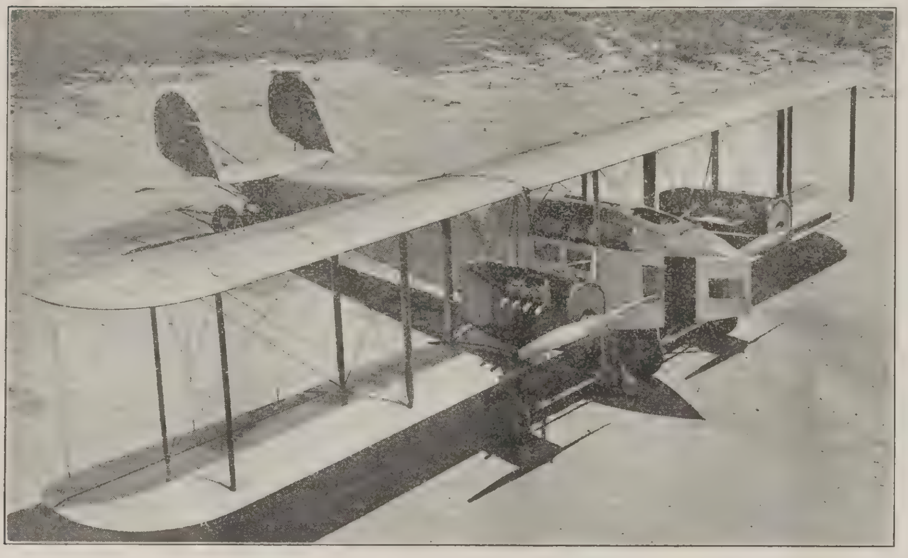
"The performance of the ship shown in the test work done so far is remarkable. The motors both turn the same R. P. M., but are about 100 R. P. M. under normal. This would indicate the propellers were not proper for the engines. It will be within reason to expect a further increase in an already fine performance, as we know a J. N. with the engines turning a 100 R. P. M. under normal would not get off under the same conditions.

Lateral Control

"The Dep" control is used, and is very efficient. The control ratio seems to be correct, and very little movement on the wheel is necessary. The ship has at least fifty per cent more aileron than even an exceptional condition would call for. This control is very natural, both in movement and in results.



Side view of the Barnhart "Wampus-Kat"



The Barnhart "Wampus-Kat"

Horizontal Control

"The elevator control is sufficient to control the ship at all speeds, but does not have so much surplus control as does the aileron. The action on the machine is slower than the aileron action. One unaccustomed to the machine would have the impression that the elevators are too slow in action. However, it is but natural to assume that a long fusilage machine would be slower on the elevators than a short fusilage. Then too, a cargo or passenger machine should have all the smoothness in operation possible, and avoid all quick and violent pitches of the machine. The machine is so stable that the elevator control is sufficient, with a reasonable over-amount. The only benefit in making it faster would be to be more nearly like the average ship in the control.

Rudders

"The rudders are sufficient with a small, but enough, surplus control when but one motor is running. When both motors are running very little rudder is needed to get the desired result. The ratio can be varied very easily to satisfy conditions."

Instrument Board

"All instruments are in full view of the pilot, and mounted so as to be easily readable.

General Performance

"The machine is very easy to fly, take-off and land. It flies very naturally and is very stable. But very little control is necessary at any time, even in rough air. It makes very natural turns to either right or left, and makes them equally well flying level or in a climb. When stalled the ship recovers quickly, and when stalled settles slowly with no tendency to spin or fall violently.

"The horizontal balance is the same whether loaded or empty, flying level or gliding. The addition of load does not change her climb to any great extent. The glide is good, and she keeps her speed at a small gliding angle. The general controllability under all conditions is excellent.

"When one motor quits or is abruptly shut off, the ship does not swing abruptly, but turns toward the dead motor very slowly. There is ample time to stop all turn with the rudder. This is a very great point in favor of the machine.

"The ship flies level on one motor at 2400 feet with 90 gallons of gasoline on board and one passenger. She flies level at 1500 feet with the same gasoline load and two passengers on board. This is, of course, with the one motor only turning 1300 R.P.H., its present maximum. It requires about 2 inches of down aileron and roughly 2/3 of the total rudder. It can be turned to either direction."

A detailed description of the structure follows:

Wing Structure

There are seven wing panels: A top center section which extends from the right engine mounting to the left engine mounting; two lower sections which run from fusilage to engine mounting; the upper and lower outer panels are of same size and shape.

Four ailerons are used and are of ample size to give control at the stalling speed. All aileron control wires are external so that they may be watched.

The machine has no stagger or dihedral. The wing curve is R. A. F. No. 6 A, and is employed on account of its high lift and low resistance.

The struts form a three bay-system with lift wires double and landing wires single. Between the fuselage and engines all wires are double.

The wing spars are of hollow box girder construction with block internal and external strut points. The blocks are all properly tapered so as to allow the bending stress being brought in gradually to the strut points.

The ribs are spruce webs with lightening holes and reinforcement for horizontal shear. The attachment to the spar is "U" shear blocks which insures the ribs and relieves the cap strips of this vertical shear load.

The cap strips are spruce with a groove for the ribs.

All internal and external fittings are of clean cut simple design so that it is possible to produce these fittings in the field and also procure the material, which is mild steel.

The wings are all internally braced for drift which eliminates all external drift wires. The entire internal drift system is double steel wired with turnbuckles for adjustment.

All external strut fitting bolts straddle the spar and are retained from sliding by special blocks and bolts through the neutral axis of the spar which gives the fittings a permanent tie.

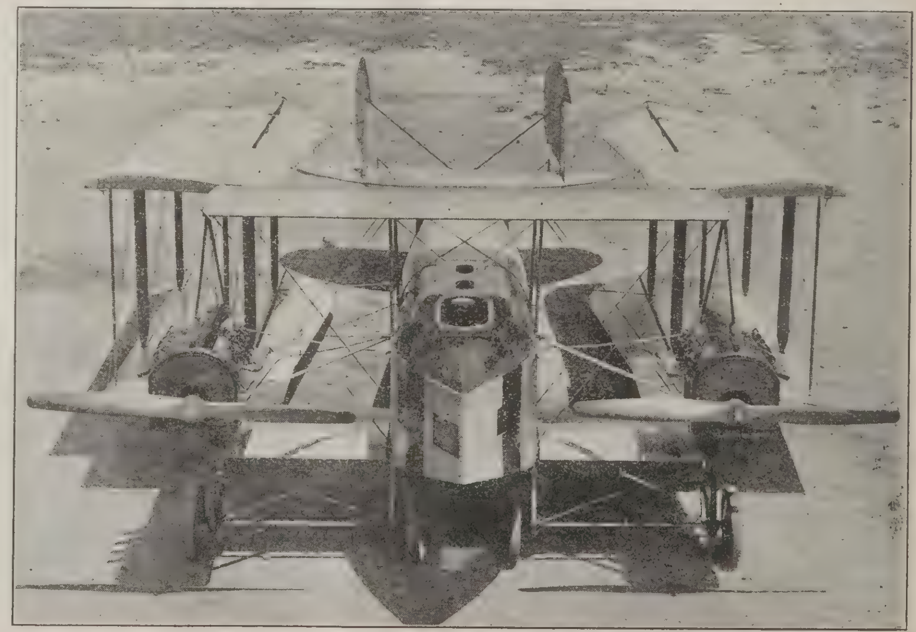
Where the wings join the fuselage, or each other, there are pin joints parallel to the neutral axis of the spars.

The panels are covered with grade "A" linen sewed to the ribs in accordance with government practice, six coats of dope and three coats of Cosmolac vernish.

Folding Wings

To fold the wings requires little or no time, and is accomplished by pulling four master pins and four lock pins. Dummy or auxiliary struts are provided which properly space the upper and lower planes in relation to their fittings. There are also provided spacer bars which tie the wings to the fuselage at the rear outer.

In testing, the machine has been towed over the very roughest ground at 30 M.P.H. with the wings folded and there was no shake to the wings nor was any alignment or tightening of wires required. In trucking a machine to the field, in the customary manner, the machine must be entirely dismantled, and then set up at



The Barnhart "Wampus-Kat" folded

the field. This new machine has been towed through streets and traffic with the wings folded back. After arriving at the field the machine only required a matter of minutes to make ready for flight.

The hinge on which the wings turn is a universal joint so that there can be no overloading of it due to any angularity of the wings or deflection of the spars.

With the wings folded the engines can be worked on with ease; also there is not the danger of tools being laid on the wings or dropping through the wings.

Fuselage

The main load carrying structure of the fuselage is of a fine streamline form and the cabin is constructed so as to give the greatest and proper strength for the least weight and so that repairs or adjustments may be made readily. This structure has four ash longitudinal members and spruce struts for lateral and vertical members. The structure is trussed with high strength steel wire with turnbuckles for adjusting tension of wires.

The floor and dome of the pilot's and passenger's cabin is of mahogany 3-ply wood with natural finish.

The four seats in the passenger's cabin are readily removable which allows the number of people or goods to be carried to be arranged for in any suitable manner of load. There is ample room behind the rear seats for luggage.

Ventilation doors are provided in the dome as well as a large sized door.

Two windows are provided for each passenger and a large negative observation lens is in the floor ahead of the passengers. This lens is in convenient position for all passengers to view the ground.

In general the passengers are provided with a fine opportunity of seeing without any inconvenience.

Ample room is provided so that no passenger will be at all cramped or confined as the floor space is six feet long by forty-four inches wide.

All control wires and attachments are protected against clothing or jamming by passengers or goods.

The cabin walls and cushions are dark grey Fabricoid.

The entrance to the pilot's and passenger's cabin is through the floor in the nose of the machine, and entrance is made with great ease. The pilot's cabin is in the nose and is in front of the passengers. For vision the pilot has three side windows, one floor window, and in addition his head and eyes are considerably above the dome.

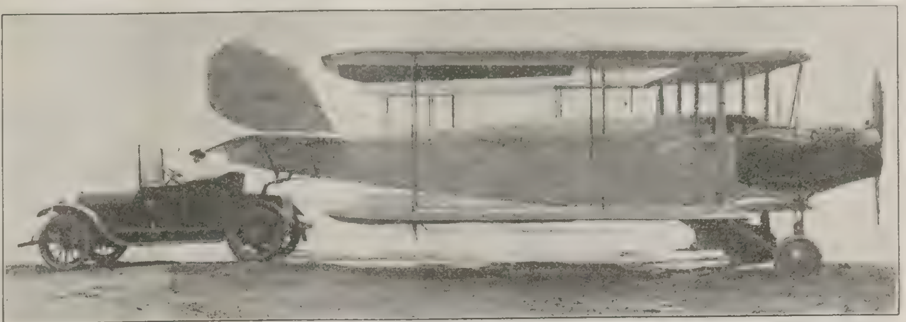
With this arrangement he can watch his engines as well as view the ground and horizon.

Special "Dep" control is provided for elevators, ailerons and rudders. A hand throttle is provided by which one or both engines can be opened or closed. Spark retards extend into the cabin. The ignition switches are within easy reach as are all other controls. The instrument board is composed of one instrument of each of the following for each engine: tachometer, oil pressure gauge, and thermometer. There are also a clock compensated for altitude, and an altimeter.

It is perfectly safe to smoke in the passenger's and pilot's cabin, for there is no gasoline vapor in these cabins.

When in the cabin all is clean, for there is no oil, gasoline, or carbon monoxide as is in most cases true of single engined machines. Dress clothes can be worn with perfect convenience, for no helmet or goggles are needed by the passengers.

The outside of the entire fuselage except the cabin dome is linen covered. The



The "Wampus-Kat" as a trailer

fabric is laced to the longerons and struts. The fabric is laced on three sides of the fuselage, namely, bottom and sides, with a detachable streamline cover for the top rear of the fuselage.

The fuselage is large enough for a man to work inside in making any adjustment. With the laced fabric and breaker strips he can open any portion which might require repairs.

The design of the fuselage is such that consistent and uniform strength is maintained throughout and repairs can be easily and quickly made.

Chassis

The chassis is of rugged construction of the four-wheel type. The use of the four wheels allows the machine to ride smoothly over the worst of rough ground and also has the feature of allowing two tires to be blown off without injury to the ship in landing.

The chassis construction is of wood and steel. The four main vertical and diagonal bow struts are nine lamination ash. The front and rear struts are a continuous loop to allow no digging into the ground of the strut ends and to allow a smooth place on which to wrap the shock absorber. The bow struts of ash are 2⅛" x 2" and are streamlined with a hollow spruce fairing. The entire strut assembly is wrapped with linen treated with dope and natural varnished surface.

Steel spools with the side thrust and ground friction arms are used on which to wrap the rubber exerciser cord. There are reach wires which allow the rubbers to absorb six times the weight of the machine. Any additional load in landing is transmitted direct to the struts through the reach cable.

Spreader tubes of steel extend between each pair of front struts.

The bracing is by double steel cable in the plane of the front struts and single steel cable in the plane of the rear diagonal struts.

In every way the chassis is of simple and rugged construction which can be dismounted, adjusted or assembled quickly.

Engine Mounting

The engines are mounted on steel tubing beds with wood vibration breakers. The bracing is of "V" type and all ends are pin-jointed. In this assembly, by removing six main pins the cowling, radiator and engine can be removed as a complete unit. This would mean a great saving in time in the operation of an air line. The cowling, radiator, in fact all could be assembled before setting in the machine—thereby not keeping the machine out of operation as long as by dismantling each component part of the power plant.

The main engine bolts do not pierce the tubing bed but are rings with studs.

The radiator is supported by setting on a felt pad and is tied from the top to keep out fore and aft movement.

As a fire preventative, all structural members are of steel with only a wood vibration strip.

Cowling

The cowling is so arranged that by closing the rear fire door or shutter, it is possible to use any of the gases or liquids for extinguishing any fire.

The entire cowling is of aluminum and is in five removable sections so as to allow for working around any particular part of the engine with ease and without removing any but the one section.

All pipe line constructions are of the olive and special fabric lined moulded rubber hose connections.

The general specifications for B.T. 15, especially designed and built commercial transport aeroplane for handling goods, passengers, and mail, are as follows:

High speed at sea-level....85-90 M.P.H.
Slow speed at sea-level.....43-45 M.P.H.
Climb to 3500 ft. with full load in 10 minutes.
Service ceiling ....10,000 ft.
Actual ceiling ....11,600 ft.
Total horsepower 180
Total wt. of the machine empty except water ....2611 lbs.
Total wt. of the gasoline and oil for 4½ hrs.................... 540 lbs.
Total wt. of the pilot and 4 passengers .... 800 lbs.
Total wt. of useful load.1404 lbs. or 34.9%
Total wt. of pay load.. 640 lbs. or 15.93%
Total wt. of the machine fully loaded ....4015.065 lbs.
Total wt. per sq. ft. of surface .... 8.23 lbs.
Total wt. per horsepower.... 22.3 lbs.
Total span wings folded...........22 ft.
Span over all, upper wing........50 ft.
Span over all, lower wing.........50 ft.
Chord upper wing................ 5.5 ft.
Chord lower wing................ 5.5 ft.
Gap ....6 ft. 8 in.
Stagger 0
Dihedral equivalent ....1°
Over all length...............30 ft. 10 in.
Over all height................11 ft. 0 in.
Wing section high lift and low resistance R.A.F. 6 mod. A.
Area upper wing (excluding ail.) ....233.32 sq. ft.
Area lower wing (excluding ail.) ....210.33 sq. ft.
Total area (including 4 ailerons) ....484.9 sq. ft.
Area (2 upper and 2 lower ailerons) .... 41.25 sq. ft.
Area Stabilizer .... 36.00 sq. ft.
Area elevators (2)......... 23.00 sq. ft.
Area fins (2).............. 10.30 sq. ft.
Area rudders (2)........... 19.00 sq. ft.

The machine has folding wings which will allow it to go into a hangar 22½ feet wide, and 34 feet long, and 11 feet, 6 inches high.

The seats for the passengers can be removed and will allow a space unrestricted by struts, wires or projections of 6 feet long, 44 inches wide and 48 inches high.

THE EMPLOYMENT OF AIRSHIPS FOR THE TRANSPORT OF PASSENGERS

Indications on the Maximum Limits of Their Useful Load, Distance Covered, Altitude and Speed*

By UMBERTO NOBILE

Director of Italian Aeronautical Construction

Technical Note of the National Advisory Committee for Aeronautics

1

As an indispensable premise to this study it should be stated frankly that it is rather risky to judge of the approximate weight of an airship of large cubic capacity,** say, 300,000 cubic meters, by taking as a basis the anticipated weight of a similar airship of small cubic capacity, say, 30,000 cubic meters.

Even were it possible, by applying the principles of mechanical similitude, to establish exact laws of variation for the weights of the various constituent parts of the airship, the previsions would still be far from the reality, especially for very large airships. It may, in fact, happen that with increase of dimensions we find ourselves, at a certain point under the necessity of radically modifying this or that part of the airship, or we shall have to adopt materials having characteristics different from those used in the model, or insurmountable and unforeseen difficulties in workmanship and assembling may constrain us to abandon that type of airship or completely change the cubic capacity.

It is, however, undeniably useful to try to establish, even by a very rough approximation, the laws governing the weight of similar airships which may give a sufficiently clear idea of the greater or lesser advantages to be obtained by a given cubic capacity. But, when, having established these laws, we find, as in fact, we do find, that the unit weight first decreases to a minimum value in relation to the cubic capacity X and then increases until, in the cubic capacity Y (limit cubic capacity) the weight absorbs the whole of the lifting force, we must consider the values of X and Y as being acceptable only as indications of *their order of magnitude*, since it may well happen that, for instance, for one of the reasons above indicated, the limit Y may be reached more rapidly, or even exceeded.

2

In applying, whenever possible, the laws of similitude to airship structures, we will keep in mind:

(a) That the principal static efforts produced, either by weight or by the pressure of the gas, may, with sufficient approximation, be considered as proportional to the cubic capacity V. Consequently, the stresses in the various parts are proportional to V, and therefore the weight is proportional to $V^{4/3}$.

(b) That the main dynamical efforts due to air pressure, are proportional to $V^{2/3}$ and consequently the weight of the various structures varies proportionally to V.

3

We will limit our investigations to the semi-rigid Italian T type, but it is obvious that, by generalization, the law of variation that we shall establish is applicable to any other type of airship and, in particular, to the rigid Zeppelin type, with some slight modifications in the numerical coefficients introduced in the general formula expressing the weight of the airship in function of the volume and maximum velocity.

By the maximum velocity of the airship we mean that velocity which it can safely develop at a low altitude, say, at 300 m. above sea level. This velocity, expressed in km/h., we indicate by w.

In speaking of the weight of the airship we will consider the following parts:

The external envelope and accessory organs;
The stiffening part of the bow of the envelope;
The stabilizing and control planes (keel and rudders);
The frame structure and accessories;
The maneuvering devices (landing, mooring, etc.);
Electric light plant, wireless plant, fans, etc.;
The pilot's cabin;
The passenger cabin;
Reservoirs for benzine, oil, and water.

Besides this, in order to complete the evaluation of the weights which, unlike those of the fuel and the useful load, remain constant, and cannot be dispensed with, we will also consider the following weights:

The crew;
Engine spare parts and various necessary tools;
The reserve ballast and the ballast corresponding to the first 300 meters;
The reserve stock of benzine and oil.

4.—The Envelope

The envelope comprises:
The external envelope of the gas bag;
The separating diaphragm between the gas and the air, commonly called the internal ballonet;
The ballonet on the beam;
The transversal diaphragms;
The connection between the frame with the keels and rudders;
The gas and air valves with their corresponding controls.

In the rubber-covered and varnished envelope employed in the various parts of airships, we must always distinguish the weight of the canvas part from the weight of the rubber and varnish applied to it. The function of the rubber is essentially to render the bag gas-proof and, consequently, in theory, by fixing the tolerance limit of the daily penetration of air in a cubic meter of hydrogen, the weight of rubber for every square meter of the gas bag surface may decrease with the increase of cubic capacity. In practice, however, for various considerations we may assume the unit weight to be about constant, and therefore the total weight of the rubber may be taken as proportional to $V^{2/3}$. The same proportion holds for the weight of the varnish.

External Envelope.—The weight of the external part of the gas bag minus the weight of the rubber obtained as specified above, may be taken as proportional to $V^{4/3}$. In fact, while from one side the surface increases as $V^{2/3}$, on the other hand, the tension (and consequently, for the same specific resistance, the thickness also) increases in proportion to the pressure and to the radius of curvature, that is, in proportion to $V^{1/3} \times V^{1/3}$.

Diaphragm Separating the Gas from the Air.—This gas tight diaphragm, interposed between the hydrogen and the air, must never come under tension. It must serve only as a means of holding the rubber and therefore its total weight may be taken as proportional to $V^{2/3}$.

Transversal Diaphragms.—These must be capable of withstanding a given difference of pressure between two adjacent gas compartments. It is, however, rational to consider such difference as being proportional to the mean pressure of the gas and, therefore, proportional to $V^{1/3}$. Consequently, we may assume that the total weight of the diaphragms varies in proportion to $V^{4/3}$.

Implicitly we have also assumed that the number of diaphragms is always the same.

Connecting Links.—The tensions in the links connecting the external gas envelope and the longitudinal beam (catenaries) are proportional to V. The weight of such elements is therefore proportional to $V^{4/3}$.

Regarding the elements or links connecting the envelope with the keels and rudders, it should be remarked that, as we shall see later on, the total forces acting on them are proportional to $V^{2/3}$. Also, the stresses to which are subjected these connecting links (except the stresses produced by inertia) fall under the same relation of proportionality, and therefore the weight of these connecting links will vary in proportion to V, considering that their length increases in proportion to $V^{1/3}$.

Gas Valves.—For simplicity's sake we will assume that the dimensions of these valves remain always the same.

In this case, increasing the pressure of the gas in the proportion of $V^{1/3}$, the holding power of each valve increases in the ratio of $V^{1/6}$. It follows that the number of valves, and consequently, their total weight, varies in proportion to

$$\frac{V}{V^{1/6}} = V^{5/6}.$$

In order to avoid introducing this new exponent, considering also the relative smallness of this weight, we will assume that the weight of the gas valves is proportional to $V^{2/3}$. On the other hand, this difference in the law of variation may be realized by suitably increasing the dimensions of the lifting part of the valve only, up to the limit allowed by the strength of the other parts.

*From the "Giornale dei Genio Civile," Anno LIX, 1921.
**For the sake of simplicity and clearness we shall use no unusual or out-of-the-way terms, but only such as are in current use, as cubic capacity, empennage, ballonet, etc.

Control Cables.—According to the hypotheses given above, the weight of the cables controlling the valves is numerically proportional to $V^{2/3}$, while their length is proportional to $V^{1/3}$. We may therefore take their total weight as proportional to V.

It should be remarked here that, in practice, constructors will probably avoid having an excessive number of valves and valve controls which would entail a more rapid variation of weight, unless the structure of the valve could be altered for the purpose of making it less heavy.

Air Valves.—In this case, considering the less favorable conditions of functioning, we must assume the pressure to be constant. We may therefore assume the number of valves, and consequently their total weight to be proportional to V.

Consequently, the weight of the control cables increases in proportion to $V \times V^{1/3} = V^{4/3}$.

Total Weight of Envelope.—We have now analyzed the weights of the various parts of the envelope of our model airship, and thereby obtain the following expression for computing the total weight of the envelope:

$$2.410\ V^{2/3} + 0.008\ V + 0.00374\ V^{4/3}.$$

5.—Stiffening of the Bow

The unit pressure exerted by the air on the surface of the stiffened part of the bow is proportional to the square of the velocity. Since, however, the linear dimensions are proportional to $V^{1/3}$, the bending moments, and consequently also the resulting stresses, are proportional to $V^{1/3}v^2$. On the other hand, the total surface varies in proportion to $V^{2/3}$. It therefore follows that the total weight is proportional to $V\ v^2$.

In order to be exact, we should also consider the secondary stresses due to the weight itself, stresses which, of course, increase more rapidly than the preceding ones. These, however, are negligible especially in the upper part which rests on the envelope.

In the case of our model, the total weight of the stiffened bow (including its covering) is given by:

$$10^{-6}\ .\ 1.3\ V\ v^2$$

where, as always, V is expressed in cubic meters, and v in km/h.

6.—Stabilizing and Control Planes

It is extremely difficult to establish a law governing the variation of the weight of the stabilizing and controlling organs, and would first of all require a close examination of the various points connected with these functions, an examination which we cannot enter into here.

We will therefore make only a rough approximation by the aid of simplifying hypotheses. For instance, we shall not distinguish between the fixed and mobile planes, assuming that, according to the requirements of steering, a greater or smaller part of the total surface area may be rendered mobile without greatly affecting the mean unit weight.

Vertical Planes.—Considering only the stabilizing function, it is evident that the total area of these planes must be proportional to the surface area of the envelope, if the righting moment due to the action of the air on the former is to be proportional to the upsetting moment caused by the action of the air on the latter.

On the other hand, the unit pressure may be assumed to be constant, and it then follows that the total weight of these planes varies in proportion to V.

If we now consider the variation of speed, it is evident that, for increased speed these planes should be suitably strengthened, though it is difficult to establish a priori in what measure this should be done. But on the other hand, with increased velocity the deviations due to the disturbing cause diminish, and therefore if we wish to keep the stability constant we may reduce as required the area of the planes. So that, for the sake of simplicity and as a rough approximation we may say that the total weight of these planes is independent of v.

Horizontal Planes.—For these planes we might employ the same general considerations as for the vertical planes, were it not that the case is rendered more complex by the static righting moments which increase in proportion to $V^{4/3}$. However, considering only the stabilizing function, the total area of the planes in question may increase less rapidly than $V^{2/3}$, and therefore the total weight may vary less rapidly than V.

When, instead, we consider the regime of movement along inclined trajectories, we easily come to the conclusion that if we wish, for instance, to maintain the maximum climbing speed unchanged (that is equal to horizontal velocity, the maximum tangent of the angle of climb), it is necessary to increase the angle of attack, thus bringing about an increase in the unit pressure and therefore in the unit weight.

It is also useful to consider that by increasing V the mobile part of the horizontal planes must increase more rapidly than the fixed part. This may lead to notable modifications in the design which, in turn, will produce new uncertainties in the evaluation of the weight itself.

From the various considerations so far made, we may conclude that, as a rough approximation, the weight of the horizontal planes varies in proportion to V.

For our model we find that the total weight of the empennages may be expressed by 0.043 V.

Rudder Controls.—The forces acting on the rudder control cables may be taken as proportional to $V^{2/3}$ and likewise their sections. Their weight is therefore proportional to V.

In our case, comprising also the control devices in the pilot's cabin, we have, for the total weight, 0.004 V.

7.—Longitudinal Beam

The complexity of the forces acting on the framework (longitudinal beam) makes it extremely difficult to establish a formula giving the variation in weight with sufficient approximation. We will again refer to the exceptions made at the beginning of this paper and here also, for the considerable item of the weight of the airship, we must be satisfied with a rough approximation.

The longitudinal beam is simultaneously acted upon:

(a) By the static forces due to the loads it has to sustain, namely, the keels, rudders, power plant, fuel, and useful load.

The total weight of all these loads is represented by the difference between the total lifting force, f V, and the sum of the weights of the envelope, the larger part of the keels, and part of the stiffened framework. This weight can, therefore, only be expressed by a rather complex function of the volume.

However, on analyzing the above mentioned expression, we find that this total weight may be taken, with an approximation of 5%, as proportional to V.

On the other hand, for obvious reasons it would be difficult to vary the volume without altering the distribution of load in the model. Since it is evidently impossible to provide beforehand for such variations and even more impossible to account for them, we must inevitably accept the simplifying hypothesis that the distribution of load remains the same.

Admitting this hypothesis, we are justified in saying that the forces due to static loads are proportional to V and consequently, that the weight of the longitudinal beam increases in proportion to $V^{2/3}$.

(b) By the dynamic forces brought about by the action of the empennages. These forces, according to the considerations made above, must be taken as proportional to $V^{2/3}$ and therefore the increase of weight in the armature due to them is proportional to V.

(c) The dynamic forces due to the thrust of the propellers, or, which is the same thing, the reaction exercised by the air on the various parts of the airship when its axis is parallel to the line of flight. This reaction is proportional to $V^{2/3}\ v^2$ and consequently the resulting efforts in the armature vary according to the same law of variation.

We must however distinguish between v constant and v variable when evaluating the increase in weight due to these forces.

In the first case, combining the dynamic forces in question with the maximum least favorable forces enumerated in (a) and (b) (calculating these by means of various hypotheses on the distribution and value of the useful load and of the load of fuel, oil, and ballast) the result is that the increase in weight in the armature due to such forces, remains always proportional to V.

Things are much more complicated when the velocity is taken as being variable, because in that case, for a sufficiently high value of that velocity it may happen that, at a given moment, the reacting force of the thrust of the propellers in a given element of the armature will prevail over the forces a + b, thus giving rise to an increase in the weight of that element, which does not happen in the model due to the fact that the sign of the maximum resulting effort is reversed. It is easily understood that, under these conditions, it is not possible to find the means of accounting for such an eventuality.

However, considering that the dynamic forces of this category are small when compared with those of the two preceding categories, and considering also that the velocity limits attainable are relatively low, we shall be able to say, with a degree of approximation sufficient for the nature of our study, that the increase in weight due to the thrust of the propeller is proportional to $V\ v^2$.

In the case of our model, summarily analyzing the effects due to the three kinds of forces mentioned above, we will consider that a sufficiently clear statement of the total weight of the longitudinal beam is given by the following formula:

$$(10^{-6}\ .\ 0.5\ v^2 + 0.022)\ V + 0.00236\ V^{4/3}$$

8.—Accessories of the Longitudinal Beam

We shall consider as accessories the covering of the beam, the internal gangway, and the pneumatic shock absorbers.

The prevailing forces are those due to the action of the air. In consequence of these forces the weight of the cover-

ing of the beam varies in proportion to V v^2 and, for our model we have : 10^{-6} . 1.3 V v^2.

The Gangway.—We should remember that live loads, though remaining invariable in absolute value, increase numerically at least in the proportion of $V^{1/3}$. Therefore, assuming that the width of the gangway remains the same and that the number of supports remains also the same, the bending moments increase proportionally to $V^{2/3}$ and likewise the weight itself.

It is probable, however, that the constructor gains in weight by increasing, if possible, the number of suspensions of the envelope, but, on the other hand, it is probable that this will involve increasing the width of the gangway. In conclusion, therefore, it seems that we are justified in assuming the weight to vary in the proportion of $V^{2/3}$ as stated above.

For our model we have: 0.374 . $V^{2/3}$.

Shock Absorbers.—The forces to which the shock absorbers are subjected are about proportional to the cubic capacity of the airship. We may therefore assume that their number or length must be increased with increased cubic capacity, leaving the width unchanged. In that case the total weight will increase in proportion to V. For our model the value is 0.003 V.

9.—Engine Sets and Supports

After determining the maximum velocity which the airship must be capable of attaining, the power required may be taken as proportional to $V^{2/3}$ v^3 and in inverse proportion to the propeller efficiency:

$$N = \frac{k}{\eta} V^{2/3} v^3$$

For our type of airship, expressing v in km/h, we may assume:

$$k = 10^{-6} \times 1.05$$

and therefore for $\eta = 0.7$.

(1) $N = 10^{-6}$. 1.5 . $V^{2/3}$ v^3 *

We may admit that the weight per horsepower, which we will call π remains constant, and we may also admit that the weight of all the accessories (radiators for water and oil, taken as full; piping system; starting devices; controls; instruments; propellers) is proportional to the power and averages 0.65 kg. per h.p. For engines weighing 1.20 per h.p. we may therefore consider the total weight of the engine set to be about 1.85 kg. per h.p.

As regards the supports, the forces to which these are subjected are partly static, proportional to the weight of the engine set and therefore to $V^{2/3}$ v^3, and partly dynamic proportional to the thrust of the propellers. If we assume, therefore that their number remains unchanged, their weight must increase in proportion to V.

Such an hypothesis is, however, hardly probable, since it is certain that, in order to obtain a better distribution of load, the number of supports must be increased. Such being the case, we will simply assume that their total weight is also proportional to the power developed by the engine set which, in our case, is given by 0.25 kg. per h.p.

Summarizing the total weight of the engine set we have:

$(\pi + 0.65 + 0.25)$ N = $(\pi + 0.90)$ 10^{-6} . 1.5 . $V^{2/3}$ v^3

and for $\pi = 1.20$:

$$10^{-6} \; 3.15 \; V^{2/3} \; v^3$$

*For the various types of airships constructed by us so far, we have found coefficients varying from 1.45 to 2.10. In our future constructions we shall presumably reach somewhere below 1.4. For Zeppelins the coefficient is smaller.

(*To be continued*)

OFFICERS

JOSEPH A. STEINMETZ, *President*
1421 Chestnut Street
WILLIAM H. SHEAHAN, *1st Vice-Pres.*
J. SIDNEY OWENS, *2d Vice-Pres.*
GEORGE S. GASSNER, *Sec. and Treas.*
1421 Chestnut Street

AERO CLUB PENNSYLVANIA

DIRECTORS

H. F. BAMBERGER
CHARLES L. HOWER
GEORGE S. IRELAND
FRANK A. L. LEAHY
JOHN W. PRATT
D. J. SPENCE, JR.
A. STANLEY TRUSCOTT

Interesting letters are being received by members of the Club from Mr. Joseph A. Steinmetz, the president, who is at present journeying in France and England. The following airgram was sent by Mr. Steinmetz to the *London Mail* as soon as the death of Mr. Hawker was announced:

"American Society of Mechanical Engineers, Aero Club of Pennsylvania and associates in aviation express heartfelt sympathy upon sad news of Hawker tragedy. The world can illy afford to lose such splendid men and when automotive engineers determine cause of such accidents must remove menace, particularly if caused by leaky tanks and uncertain fittings.

"JOSEPH A. STEINMETZ,
"President Aero Club of Pennsylvania."

It now appears that there was no defect in the plane as later investigation shows that Hawker met his death through physical disability. For a long time he had suffered from tubercular disease of the spine and in the opinion of the medical profession of a hemorrhage had taken place in the air, causing paralysis. The opinion that the machine caught fire is an error as according to several witnesses the plane was not on fire while in the air, the only flames being seen were those which one would naturally expect to see issuing from the exhausts.

The Philadelphia Aero-Service Corporation have started a real innovation at the Official Flying Field of the Club at Warminster. As an experiment short flights were offered for the very small amount of five dollars a trip. This caught the popular fancy with the result that they have had about as many "air tourists" as they could handle and the planes are in the air from ten o'clock in the morning until late in the afternoon. Longer trips are given at correspondingly low rates, but the short trip seems to have caught the fancy of many who just want to "try the air" and tell their friends of the experience.

The sympathy of the Club is extended to Lieutenant Louis M. Robb, former army flier who in a forty mile race with death on the night of July 27th reached the bedside of his mother within a few minutes after she had died.

Lieutenant Robb was at Parkesburg, Pa., with his plane when news reached him that his mother had been taken with a serious illness.

Jumping into his machine he flew it swiftly toward Philadelphia. As darkness was rapidly coming on he was forced to fly at a very low altitude. When he reached 69th Street he landed in an open field before a crowd who at first feared that the machine had been damaged. He arrived at his home just after death had overtaken his mother.

A most inspiring spectacle was the flight on August 1st of the sixteen bombing planes over the city. The wonderful sight of sixteen of the largest planes of the army, Martin twin Liberty motored machines, as they flew over the City Hall will long be remembered. The deep "drumming" of the powerful engines was heard for miles and the flying in formation across the city, down over the edge of League Island Park, then on to Hog Island was a most practical demonstration of how easily the country could be bombed by a hostile air fleet once it reached this country; or what is of more importance, how readily such a fleet of aeroplanes or even battleships could be repelled if Philadelphia possessed ample planes to protect against such an attack.

The next stated meeting of the Club will be held at the club rooms, 1026 Walnut Street, at 8 P. M., September 16th. A large attendance of the members is requested as business of importance will be brought before the meeting. Reports of the various committees will be made and a course of activity for the coming months will be mapped out. The annual nominations for elections will be held in a few months and there is a growing feeling among the older members and those who have held office for many years that as the Club now has so many active new members who are working hard to build up the membership, they should be honored by election to office.

It is planned to arrange to hold a photographic contest for the Henry M. Neely cup in the early spring. No contest has been held for this trophy for many years and as interest in aeronautical photographic work is being shown by the new membership of the Club it is believed that such a contest would arouse much interest and would help in the drive for membership which will be carried on during the Fall months.

The Biddle cup for Model Contests now holds a prominent place in the Club room and it is hoped to have the Neely cup placed beside it with the name of the latest winner properly inscribed upon it.

W. H. SHEAHAN,
1st Vice President.

NAVAL and MILITARY AERONAUTICS

Forest Fire Patrol Work

What the Air Service is accomplishing along the line of forest fire patrol work and the method of operation is partly shown by the following outline of the work carried on during the months of May, June and July by Flight B of the 12th Observation Squadron, the headquarters of which is at Nogales, Arizona:

Geographical survey maps marked off into corrdinate sections were used; on spotting the fire the observer communicated with the nearest radio station. Radio stations were located at Tucson and Nogales landing fields. In making the radio report the following method was used:

(a) Station call, three times.
(b) Key letter for route and observer.
(c) Fire—FFF.
(d) Old fire—O. New fire—N.
(e) Location by coordinates.

The maps were coordinated into five mile squares, which were further subdivided into one mile squares. In reporting a fire its location in the five mile block was first given as, for example, I-K. It was further located in the one mile square by the additional coordinates of the one mile square in which the fire was located. The one mile squares were divided usually into four quarters. The upper left hand corner numbered; the upper right hand corner 2; the lower right hand corner 4; and the lower left hand corner 3; thus placing the fire within one quarter of a mile of its location. A typical location might be "7 K 3 A 2." This would locate a fire in the five mile block, 7 K; in the one mile block 3 A, and in the upper right hand quarter mile section. The system of coordinating was a very simple one, as follows: each five mile block was numbered from left to right and lettered with capital letters from top to bottom, the one mile squares were similarly numbered from left to right and lettered from top to bottom with small letters.

(f) Area in acres—A15 (fifteen acres) AS (less than one acre).
(g) Cover—CT (Timber)
CB (Brush)
CO (Open)
CX (Burned or cut over)
(h) Slope—SL (Level)
SG (Gentle)
SS (Steep)

Report on slope was followed by direction letter, N.S.E.W. Thus a typical report under (h) would be "S G N," indicating sloping gently to the north.

(i) Ground wind velocity and direction as, for example, "15 N" would indicate north wind of 15 miles per hour. If there was no wind the observer reported "No" under (i). Thus a typical fire report would be "ZD, ZD, ZD, XY, FFF N, 7K 3B1, AS, CB, SGS, 15N."

Immediately upon receiving the radio report, the operator relayed the report to Forestry Headquarters by telephone.

The observer made record of all information sent by radio and turned this information in at the radio station immediately upon landing. This information was telephoned to Forestry Headquarters to act as a check on the radio communication. The observer while patrolling, if there are no fires to report, nevertheless communicated with the radio station every ten minutes as follows:

(a) Station call repeated three times.
(b) Key letter for route and observer.
(c) RAS—signifying nothing to report.

The observer was required to check out with the radio station by a system of panels before leaving the vicinity of the airdrome to insure that his radio set was properly functioning. For this purpose each observer has a key letter, also a key letter for the route he is patrolling and a corresponding panel for key letter.

A coordinated map is kept in the flight operations room. All forest fires were marked on the map. Active fires known and located were marked with red-headed pins, old fires extinguished were marked with black-headed pins. New fires discovered by the observer and not notified by Foresters were marked with yellow-headed pins. The pilot and observer were required to report to the operations room and carefully study the map, verify the location of all fires on their maps, and receive such other information and instructions that might pertain to the day's patrol. Immediately upon landing the pilot and observer again proceed to the operations room, reporting all information they have gained.

During the time of this patrol Forestry officials were permitted to ride over the forest areas patrolled, in order to assist them in fighting fires. In each case the Forestry officials were required to apply in writing to the camp commander. The usual release form was used in every case, and a report of each such flight made with the name of the Forestry official, was submitted to Corps Area Headquarters.

Aerial Regulation of Heavy Field Artillery Fire

The U. S. Army Balloon School at Lee Hall, Va., adjoins Camp Eustis, the home of the Heavy Railroad Artillery, and as considerable firing was done this summer, the observers had excellent practice in regulating the shots. Whenever the weather permitted, the balloon was in ascension, although owing to the shortage of personnel it was necessary to call cooks from the kitchen, and get out every other available man on the ropes, and it was only when lightning appeared that the balloon was hauled down.

The artillerymen had a number of ground O.P.'s in tall towers for terrestrial observation, and employed the usual method of having observers report the impact on the Observation-Target Line. The balloon was about nine kilometers from the target, and invariably gave readings on the Battery-Target Line, though on several occasions the angle between Balloon-Target and Battery-Target was large. During the course of a shoot, the balloon was frequently complimented by the battery on the accuracy of the observations, as the greater height of the Observer's Position enabled the actual point of impact to be reported.

At the various artillery critiques following the shoots, the accuracy of balloon observation was brought out, and that from the balloon observations alone the guns are regulated efficiently. The results were very gratifying, as it was recognized that in the presence of an enemy ground observation would be difficult and often impossible, especially for the Railroad Artillery, firing at long ranges. Under these conditions, balloons are of immense assistance. The cost of firing 8″ and 12″ guns from railroad mounts is very large, and accurate fire, regulated from actual observation of the effect of the fire, is a necessity.

The growing importance of heavy artillery has increased the necessity for aerial observation. Before the war, only a few 8″ guns were mounted on railroad mounts, but now all sizes up to 14″ are mobile. It is expected in the future that most of the counter-battery work will be done by railroad guns.

In the last two months the observers at Lee Hall have regulated about 1,000 3″ shots, 200 8″, and 200 12″ mortar. The balloon is especially valuable for calibrating a piece, as very accurate observation is essential. Also the use of the balloon demonstrates in the regulation of several batteries at once the rapidity with which observation may be reported by direct telephone communication furnished by the balloon.

Orders and Assignments at Langley

The following changes in assignment and duties of officers of the Lighter-Than-Air division have been made: Lt. Robert V. Ignico who for some time has been in command of the 19th Airship Company, is relieved of that duty and assigned as a student officer for the course of instruction in the Airship School. Lt. Carlton F. Bond has been relieved as commanding officer of the cadet detachment and assigned to the command of the 19th Airship Company. Lt. O. A. Anderson is relieved from further duty with Airship Company No. 10 and assigned to command the cadet detachment.

A number of enlisted men were placed on duty requiring regular and frequent participation in aerial flights. Included in this number are: Corporal Grove J. Drake, of the 1st Squadron (Observation) and Master Sergeant Harry A. Chapman, Master Sergeant William F. Fitch, Pvt. 1st c. Bruno E. Elfstrom, Pvt. 1st c. Harry D. Ritchey, Pvt. Willard N. Edson of the 19th Airship Company.

Having completed the temporary duty to which he was assigned at Langley Field, Captain Clyde V. Finter has been relieved from further duty here and ordered to report to his proper station for regular duty.

Staff Sergeant Harry W. Johnson of the 14th Squadron has been detailed on special duty with the Photographic School for the purpose of taking a course of instruction in aerial photography.

Captains John G. Colgan and Victor Parks, Jr., are among the recent arrivals at Langley Field, reporting for duty in the Field Officers' School.

Pvt. Hans L. Thompson, 96th Squadron (Bombardment) has been detailed on special duty in the Engineering Department.

FOREIGN NEWS

France To Organize First International Air Navigation Congress

Under the patronage of the French Under-Secretary of State for Air, the French *Chambre Syndicale des Industries Aéronautiques* has taken the initiative in convening an International Air Congress, to be known as the First International Air Navigation Congress, and to be held concurrently with the next Paris Aero Salon, from November 15 to 26, 1921, to afford an opportunity of discussing the various problems connected with commercial aviation. The President of the organizing committee is Monsieur P. E. Flandin, late Under-Secretary of State for Air, who will be assisted by a number of well-known French experts as vice-presidents. The President of the Technical Committee will be M. R. Soreau, who is President of the Aviation Commission of the French Aero Club. The Air Navigation Committee will be under the presidency of Col. Sacconey.

By inviting communications from all interested in the question of commercial aviation, it is hoped to establish an interchange of ideas which will be of great help in the furtherance of aviation all over the world, and give an opportunity of discussing such problems as affect the future development of commercial flying. Those who wish to help in any way towards the success or the Congress can do so in two ways —by becoming full members or by becoming associate members. The fee charged for the former has been fixed at $5.00. Full members are entitled to send in communications to the Congress, and will also receive a *résumé* of the communications. Payment should be by check or money order, made out to the *Chambre Syndicale des Industries Aéronautiques,* 9. Rue Anatole de la Forge, Paris (XVIIe). At the conclusion of the conference the proceedings will be published in full, and a copy of the published report will be obtainable by associate members as well as full members for the price of $5.00.

Printed forms of application for membership, as well as intimations of papers or communications which it is intended to submit to the Congress, can be obtained from the General Secretary, International Air Navigation Congress, 9. Rue Anatole de la Forge, Paris (XVIIe).

Communications should be kept as short as possible—about 2,000 words will be a suitable length—and should be typewritten on one side of the paper only. Line drawings may accompany the communications, but they should be carefully drawn, and the space available for their reproduction is limited to two pages of the report of the Congress. Communications and papers should be submitted before October 15, 1921, so as to ensure a *résumé* being printed in time for the Congress. Papers which arrive after that date will not be published until the issue, after the Congress, of the Proceedings.

Papers and communications may be written in either of the following languages—French, English, German, Italian, or Spanish.

With regard to the papers submitted, these should bear on one of the following subjects:

(A) Technical Committee

(1) The utilization of results of wind tunnel model tests for full-size calculations.

(2) Aeroplanes and seaplanes (monoplanes or multiplanes). Thick and thin wings. All-metal structures and composite structures.

(3) Airships with great carrying capacity.

(4) Commercial aero engines; their arrangement in the machine, and their transmission gear.

(5) Apparatus for fixing the position of an aircraft and of tracing its route.

(B) Air Navigation Committee

(6) Air routes.—Outline, management, wireless, meteorological information, aerodrome installation and ground organization.

(7) Commercial aviation.—Commercial machines (aeroplanes or seaplanes, passenger, goods and mail machines). Charts. Organization and exploitation of regular air lines. Air mail.

(8) Air legislation.—Regulations, Customs, Examination of personnel and material. Safety. Insurance.

Federation Aeronautique Internationale

It was decided to place the following subjects on the Agenda for the Conference of the Fédération Aéronautique Internationale to be held in Madrid in October next:

Aircraft Customs. The Institution of the Tryptique.

Superior Brevet.

The fixing of the dates for all International Competitions nine months beforehand.

The following delegates were appointed to represent the Club at the Madrid Conference: Lieut.-Col. F. K. McClean, Lieut.-Col. Alec Ogilvie, Lieut.-Col. Mervyn O'Gorman, C. B., Mr. H. E. Perrin (Secretary).

Gordon Bennett Balloon Race

The decision of the Meeting of the Bureau of the Fédération Aéronautique Internationale held in Paris on June 30, 1921, to regard the frontier as the landing place in the event of landings in Russia, was reported and agreed to. It was reported that the Race would start at Brussels on September 18, 1921.

French Military Casualties

The French Minister of War has just published a statement of the casualties of military aviation in the first five months of this year. From January 1 to May 31, 1921, 35 airmen were killed and 34 injured. These figures do not include airmen killed or wounded by the enemy in the Levant or Morocco. Nineteen of the accidents are described as being due to "pilot's error."

British Air Mail

In a despatch to the *London Observer,* Major C. C. Turner writes of the air mail as follows:

The unusually long spell of fine weather has been partly responsible for the punctuality of the air mails, which was recently the subject of the Postmaster-General's congratulations; but the hardest critic of air transport will admit that some little credit must also be given to the aeroplanes, engines, pilots, and organization. It is, however, necessary to bear in mind that bad weather is as certain to come as next Christmas. Now is the time to prepare for it, and to ensure that there shall be no falling off in the air mail.

Something is being done, but this is confined to a slow improvement of the average quality of the machines. With painful deliberation, additions to the cross-Channel squadrons are being made, and some of these additions are of the later types. One or two new De Havilland 18's are being used, and there are rumors about the Handley-Page W8 (both old types, but curiously hard to get). One of the new Bristol-450 h.p. Napier ten-seaters has appeared on the scene. It is said to have been "approved" under the Air Ministry's new subsidy scheme. It is high time that the De Havilland 29, a cantilever ten-seater monoplane with a 450 Napier, was put into service. With such machines as these the British lines would have nothing to fear from foreign competition. One is constrained to ask, not what, but who, is keeping British aviation back?

The Air Ministry have inspected types submitted under the new scheme, and have approved of some of them, but no orders have yet been placed. Yet there are not enough machines to cope with the present cross-Channel traffic, and the average quality of those machines is far below what it need be.

Among the new proposals is one for a resumption of the British services to Brussels and Amsterdam. Another relates to a new type of aeroplane and system of operation. The machine has easily detachable wings, engines, and fuselage, and this will obviate the need to keep reserves of complete machines and will facilitate repairs and regularity. The machine, having cantilever wings, will need comparatively little truing up. Here we see a suggestion of system; undoubtedly one of the drawbacks of the existing state of affairs is the employment of too many types by too many companies.

The Air Ministry plan of approving air transport firms using approved machines in order to benefit by the easy purchase and new subsidies schemes is excellent. Ignorant official opposition to inland air mails continues. When the new scheme bears fruit—as it possibly may in the course of time—some of the recommendations of the Aeronautical Society will see fulfilment. At present these improvements (which had for long been advocated) are simply ignored. They concern such matters as the elimination of rubber connections in the petrol installation, the abolition of propeller swinging, the provision of convenient emergency exits, easily removable engines, controllability at landing speed, and so on.

The Air Ministry are not responsible for all defects. For example, owing to the delay of the ratification of the International Air Convention they are unable to ensure the inspection of foreign-owned aeroplanes using British ports. There was a case recently in which insurance was refused, yet the machine started. The Board of Trade would not permit that sort of thing in the case of ships; why should air transport suffer this grave prejudice?

Little or nothing is being done towards the establishment of organization to deal with breakdowns and to carry on night services. Yet there will be no excuse if when the dark days come there is not full provision in all these matters. Except sheer lack of purpose, or deliberate obstruction, there can be absolutely no reason why the winter should not find the London-Continental services prepared for day and night flying in all weather except such violent storm or dense fog that puts rail and boat traffic also out of gear. The knowledge and the means are available.

Steam Engines for Airships

Invention of a system of steam propulsion for airships is claimed by Captain W. P. Durtnall, who was a British naval officer during the war, and up to a year ago staff captain in the chief mechanical and electrical engineers' department of the Royal Air Force.

It is maintained that the new system will function at altitudes hitherto unattainable with the ordinary type of internal combustion engine.

The invention is said to do away completely with the ordinary boiler, the steam being generated by means of internal combustion power or heat energy. The superheated steam heat energy is supplied to special steam motors which are reversible and can be controlled from a central control station. Only heavy oil is used as fuel, and it is claimed that the driving machinery can be safely placed inside the frame of the airship instead of in separate gondolas outside, thus bringing about a great reduction in air resistance and consequently reducing the power required for propulsion.

The engines or "steam motors," as Captain Durtnall calls them, are of the double-acting type, requiring no flywheels.

Aeroplanes and Grasshoppers

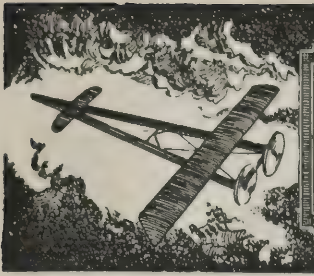
It is reported that aeroplanes are doing useful and most unusual work in France dealing with the plague of grasshoppers on the Crau Plateau (northwest of Marseilles) which is far more serious than it was last year, crops of all kinds being destroyed over some 100,000 acres. Pilots report breeding grounds and scatter poisened bran.

Dutch Line Extensions

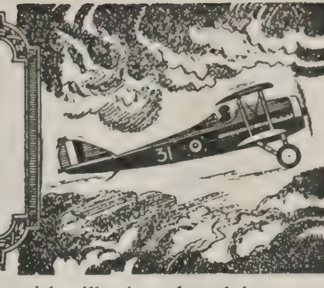
It is reported that a regular air service is to be inaugurated between London and Amsterdam, with connections to Hamburg, Copenhagen and Berlin, with a fleet of Fokker commercial monoplanes which are now being built in the works of the Fokker Company at Amsterdam. The service will, by means of the 'nterior German lines, connect with all principal German cities; while the route to Copenhagen will be extended by a seaplane service to connect with Sweden. These Dutch-built machines will be equipped with Siddeley Puma engines, which was the make used by Lieuts. Parer and McIntosh on their flight from London to Australia.

Trans-Atlantic Flying Ships

According to the London "Daily Mail" the Fairey Company, builders for the British Air Ministry of the great Titania flying boats, have in hand plans for giant Transatlantic flying ships, driven by specially designed 4,000 horse-power engines, which will have luxurious accommodation for as many as 100 passengers, in addition to fuel, crew and stores. They will, in fact, be air liners, with great hulls which, seen without their wings, one might mistake for some specially designed craft for use on the surface of the water. Starting from the lower reaches of the Thames, such vessels will be able to make a non-stop flight to New York in very little more than 40 hours; while calculations which have just been made show that with a sufficient fleet, well patronized, the fare by flying ship should be little, if any, more than by steamship. Conditions in the flying ships will approximate almost exactly to those of first-class steamship travel. Guided on their course by directional wireless, informed in advance of weather changes, and with a motive plant which is practically immune from the risk of breakdown, they will offer not only speed and comfort but also safety.



ELEMENTARY AERONAUTICS *and* MODEL NOTES



How to Build a Scale Flying Model of the Curtiss 18-T Triplane

THE Curtiss 18-T Triplane, described in AERIAL AGE, March 31, 1919, has recently been drawn up and described by Mr. C. H. Fastje. Mr. Fastje has made some very complete detailed drawings of this model but owing to lack of space it is possible only to publish a general outline plan which has been prepared especially for AERIAL AGE. Those desiring additional information on the construction of this model should communicate with Mr. Fastje at Dennison, Iowa.

The following description gives a very good idea of the manner in which to proceed in the construction.

Fuselage Construction

Secure two pieces of balsa wood 3" x 4" and two feet in length. Make a cardboard outline of the top view of the fuselage. Lay this outline or template on the balsa pieces (on the 4" sides) and mark the outlines. Cut to within about 1/32" of the outline, preferably on a bandsaw or a jig-saw. Then with the use of the template, carve out the insides of the balsa wood pieces to about ⅛" of the outside outline mark. Then the side outlines of the fuselage are drawn by using a cardboard outline of the side view. Saw out as before, on a bandsaw or jig-saw.

Work the outsides down with the use of the templates for the outside of the fuselage. Sandpaper both inside and outside of the pieces, enough to take off the rough spots and leave a shell approximately ⅛" in thickness throughout.

Cut each piece to the correct length, shellac both the inside and outside of both pieces and let dry. Then cut all the holes and places as shown for the main plane spars, landing gear struts, tail skid, stabilizer and rudder. The openings for the stabilizer plane are made by cutting grooves 1/32" deep.

Insert and nail and glue the motor stick brace in the upper piece after the openings for the cockpits and gunner's seat openings have been cut out *with care*. Be sure that both pieces fit perfectly and smoothly. Smear plenty of glue on each piece and bind together tightly with silk thread and leave set until thoroughly dry. Trim and smooth up the cockpits carefully as shown. Glue the ⅛" thick piece of veneer or wood to the front end of the fuselage, so that the nose-piece may be securely fastened to the fuselage later on.

Main Plane Construction

First of all make a pattern of the ribs out of cardboard. Lay this pattern on a balsa wood block and draw the outline. On a drill press drill the holes where the spars and edgings are to fit in. Saw out the outline on a band or jig-saw. Then cut the block thus sawn out into ribs 3/32" thick. Thirty-one ribs for the main planes are needed. The ribs may be cut from 1/16" thick white pine wood if desired. Next make the 5/32" round spar material by cutting or planing 3/16" sq. white pine wood to octagon shape and then sandpapering to 5/32" round shape.

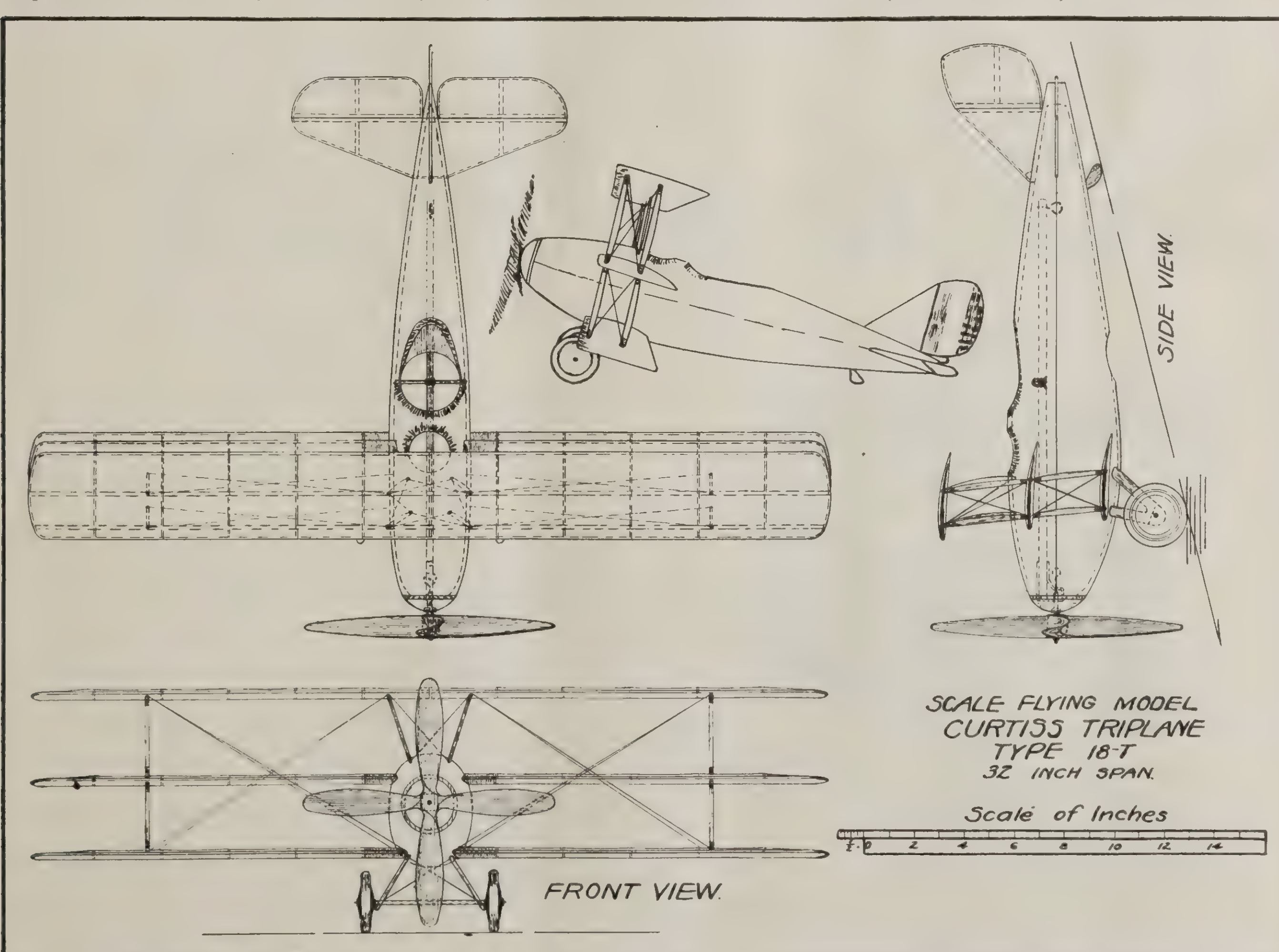
Spars for the upper plane are in one piece while the spars for the middle and lower main planes are only one-half as long. When the spars are cut, mark on them the positions of the ribs. Slip the ribs over the spars in the positions marked on them. Glue them and square up. Set away to dry.

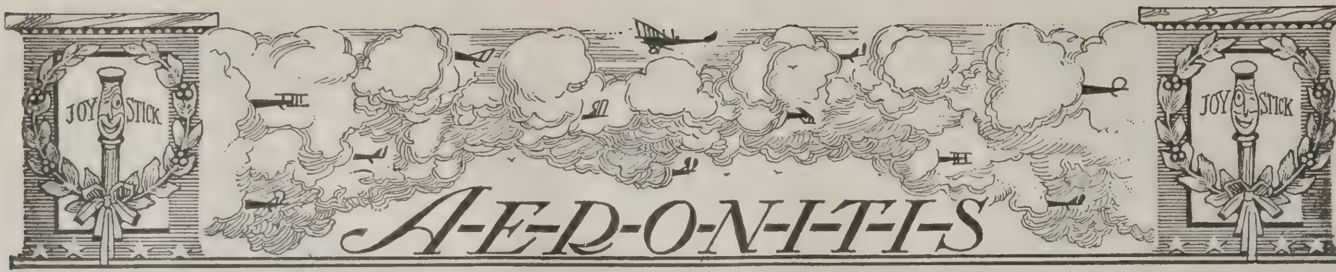
In the meantime, bend the bamboo edging to shape over a candle flame. Cut out the balsa wing sections with the grain running from the leading to the trailing edge. Secure the bamboo edging to the ribs by silk thread and glue. Slip the balsa wood wing sections on for the lower and middle planes and glue fast.

When the frames are rigid and dry, drill the 1/16" holes for the interplane strut, fastening as shown. Wrap with thread and glue so spars will not split when the interplane struts are attached.

Cover the frames with silk or silk tissue paper. Cut out the interplane struts. After the ends of the struts are wrapped with silk thread, drilled and smeared with glue, insert the aluminum wire pieces in the ends.

(To be continued)





The Aviator

By Ethel Trew Dunlap

My ship is ready and waiting to rise
Into the boundless sea of the skies.
The sun is shining and tinting the sky
With fairy colors that charm the eye;
Yet my thoughts are as cold and gray
As the path that will mark my way.

The bloom and fragrance of summer skies
Will vanish like breath when I arise.
The sailors who man their ships at sea
Are not as steady as I must be;
With eagle watchfulness I must keep
A constant vigil to sail the deep.

Drifting between the heavens and earth
The spirit is re-created in birth.
I fling defiance to airy clouds—
I mock at their fingers that wave white shrouds
The stars attract with their sylvan lights
And dim forms allure me to higher flights.

I scorn their allurements while I fly
Steady and swift through the heart of the sky.
There are sirens in the depth of the seas—
And there are sirens in heaven's breeze;
The currents of air are their mystic wings,
And they follow my ship while it flies and sings.

Forgetful of danger and gravity's tie
I fasten my gaze on the quiet sky.
Out of the silence and night-time's gloom
Science and hopes for the future bloom—
Bathed in the mystic light of the stars,
And streaked with the flashing glow of Mars.

We have measured the earth and fathomed the sea—
So heaven must yield us her mystery.
She hath hung her lamps in the kingdom above
To show the sublimity of her love.
And though I return to my earthly ties
My hopes remain in the heart of the skies.

The Homing Bird

By William S. Savage, R.M.A.

Far to the East a mere speck in the air
I saw, and simultaneously my ear
Caught a faint sound born of the object there
Which, as I watched, seemed rapidly to near.

Across the evening sky in homeward flight
The aeroplane approached—passed overhead;
Its sleek wings flashing in the fading light
Transformed to silver shafts the sun's gold red.

Suspended high in space twixt ground and sky
To gravity a loud defiance roared;
And then, to shame the grace of birds that fly,
It dipped its wings towards earth and upward soared.

Just then I saw beneath those upturned wings
Identity revealed in colors bright—
A mark composed of three concentric rings:
America's design, Red, Blue and White.

Symbolic of our strength above the earth
In seas of space as yet unchartered; And
I thought of its significance and worth:
The best defensive weapon of our land.

To think that thing of grace and beauty could
Wreak grim destruction and perhaps did hold,
Behind its frailty of cloth and wood,
Potential possibilities untold.

It has, of late, conclusively been shown
That numbers of these ships of air can go
Far seaward and, their presence all unknown
Rain poignant death on navies far below.

I pictured fleets of these in future days,
Helping defend us from aggressive wars,
Moving upon invisible highways,
To vulnerable points on far-flung shores.

Gazing above I saw (grim thoughts now done)
The Homing Bird race with descending night—
A shrinking silhouette against the sun,
Receding Westward quickly fade from sight.

A Handy Receptacle

"Bobby, what did you do with your peanut shells in the car?"

"I put 'em in the overcoat pocket of that man I was sittin' by."

Cured

"I'll fine you $10 for contempt of court."

"All right, your honor. I'll pay it, but it's a lucky thing for me that you don't know what I'm thinking."

"I'll just add another $10 for that remark."

"Your honor, my mind is now a perfect blank."

Birmingham Age-Herald.

For the past six months the skirts have been advertised as "coming down." The goods are not as advertised.

First Gob: Going to church services?
Second Ditto: No, I don't need the sleep.

If You Love Your Old Bus, Buy One of These

"A patent has been issued for a silk gauze face shield to keep dust from the eyes and noses of automobiles."

—Eugene (Ore.) Daily Guard.

Good Reason

Belle: I don't understand why Clarice lets that common grocery boy play around with her.

Buoy: Neither do I, unless it's because he delivers the goods.—*Penn State Froth.*

September 5, 1921

AERIAL AGE WEEKLY

VOL. XIII, No. 26

TABLE OF CONTENTS

The Dirigible Disaster 607
Air Laws 607
The News of the Week 608
The ZR-2 Disaster 611
The Loening Monoplane Flying Boat 613
Report of Joint Army and Navy Board on Bombing and Ordnance Tests 614
The Barnhart Twin No. 15 Wampus-Kat 615
The Employment of Airships for the Transport of Passengers......... 618
Aero Club of Pennsylvania......... 620
Naval and Military Aeronautics.... 621
Foreign News 622
Elementary Aeronautics and Model Notes 623
Aeronitis 624

PUBLISHED WEEKLY BY THE AERIAL AGE CO., INC.
Foster Building, Madison Avenue and Fortieth Street, New York City
Subscription: Domestic, $4; Foreign, $6
Entered as second-class matter March 25, 1915, at the Post Office at New York, under the act of March 3d, 1879.

From Photo by Keystone Photo

A Plane that holds Two Records—

MANY notable planes have been designed by Mr. Donald Douglas, former Chief Engineer of the Glenn L. Martin Company. But none of them is more remarkable than the "Cloudster," recently built by his own company — the Davis-Douglas Company of Los Angeles.

The "Cloudster" weighs only 3850 lbs., yet it has carried a useful load of over 5,000 lbs.—the heaviest load ever carried by a single-engined plane. And the "Cloudster" also holds the official Pacific Coast altitude record of 19,160 feet.

From long experience Mr. Douglas knows that Valspar is the ideal varnish for airplane use—that it is proof against water and wear, vibration and weather.

From tip to tip the "Cloudster" is Valsparred, of course!

VALENTINE'S
VALSPAR
The Varnish That Won't Turn White

VALENTINE & COMPANY
Largest Manufacturers of High-grade Varnishes in the World
ESTABLISHED 1832

New York Chicago Boston Toronto
London Paris Amsterdam

W. P. FULLER & CO., Pacific Coast

AVIATION
FLYING AND GROUND SCHOOL

COURSES TAKEN SEPARATELY OR COMBINED

We have the very best of flying instructors. Our ground instructors will teach you motors from A-Z and show you how to build an airplane from the ground up.

We specialize on MOTOR MECHANICS and RIGGERS

and can turn you out qualified to handle such position paying from $200 to $300 monthly.

Write for descriptive literature.

THE LOWELL AIRCRAFT CO., Inc.
Oberlin, Ohio

SEVEN carloads new JN parts at bargain prices. OX5 and OXX motor parts. OXX and Benz six cyl. 110 H.P. and Mercedes six cyl. 160 H.P. motors installed in your plane rebuilt for three passengers at surprising low cost.

We are located permanently and offer our fourteen years' continuous aviation experience. Try and be convinced. Send today for price list.

PARKER AIRCRAFT CO.
Perry, Iowa

Imported Commercial Aerial Cameras

Latest model brand new 7" x 9" GAUMONT CAMERA, 20" f/6.3 Krauss Lens, 12 plate automatic magazine suitable for mapping and obliques................$500.00
Extra 12 plate automatic magazines................ 40.00
5" x 7" GERMAN ICA CAMERA, 12" f/4.5 Voigtlander Heliar Lens including four all aluminum plate magazines 400.00

FAIRCHILD AERIAL CAMERA CORPORATION
136 West 52nd Street New York City

STONE MANUFACTURING CO., Inc.
Supreme Propellers

For immediate delivery

Future Location, 2623 Olive St., ST. LOUIS, MO.
Pioneer Propeller Builders Established 1910

Manufacturers of
SCREW MACHINE PRODUCTS
and general machine work

Nickel Steel Bolts, Clevis pins, etc.
All work from blueprints and specifications
We specialize in Rebuilding and Overhauling Aeroplane Motors

C. H. P. MACHINE CO., Inc.
107 WEST 56TH ST. NEW YORK CITY

Advertising in this department 10c a word $2.00 minimum

Classified Advertising

Forms close for this department on Monday preceding date of issue

---

PATENTS Ex-Pilot U. S. Air Service
ALLEN E. PECK
Patent Attorney
Pacific Bldg., Washington, D. C.

FOR SALE—H-S-2 six passenger Aeroplane with new Liberty Motor, Self Starter, and in first-class condition. Price right. Ideal for passenger carrying. Can be seen at or write to Riverside Park, Agawam, Mass. J. H. Allen.

FOR SALE—All OX5 motor parts brand new, reasonable prices. For example: Crank shafts $50.00. Pistons $6. Champion spark plugs $.75. Address The Lowell Aircraft Co., Oberlin, Ohio.

WING PERFORMER—Plane changing and parachute drops. Open for engagements. Will go anywhere and tackle anything. Harry Field, Box 617 c/o Aerial Age Weekly, 280 Madison Ave., New York City.

PROPELLERS—Six new Paragon copper tipped bored OX5 $30.00 each. Five new Flottorp copper tipped OX5 same $30.00. Wheels $6.00, Casing $4.00. Address Box 618 c/o Aerial Age Weekly, 280 Madison Ave., New York City.

PILOT—Experienced Army and Commercial Pilot desires position. Will go anywhere, good mechanic. L. J. Mason, 2233 Calumet, Chicago, Illinois.

WANTED—40 to 60 H.P. Aviation Motor, can use a Type A. 1.40 Hall-Scott Motor. M. Mickelson, Box 23, Callaway, Minnesota.

AMERICAN J.N.4-D, good condition, motor turn 1450 Hammondsport make. For quick sale $2,000.00. Wire or write Robt. Cochrane, Arapahoe, Nebraska.

NEW STANDARD J-1 with new OX5 motor ready for immediate delivery at Houston, Texas, $1500.00. E. J. Bond, 609 Main St., Houston, Tex.

BARGAIN—Curtiss Standard C6 160 H.P. Motor, new thruout, never flown, still at Curtiss factory. $4100 cash—a saving to you of $400. Apply to Curtiss Aeroplane and Motor Corp., Garden City, New York, regarding undelivered ship of W. L. Keough.

FOR SALE—Curtiss OX5 motor, splendid condition, completely overhauled, $300. Curtiss Canuck aeroplane just built. Exceptionally fine appearance and flying ability $1700. Box 616 Aerial Age, 280 Madison Ave., New York City.

SEVERAL AEROPLANE CAMERAS for sale with Bausch & Lomb 8½-inch (I. C. Tessa F4 5 in aerial mount), including magazine holders carrying a total of 36 plates. Cameras brand new, same as used by U. S. Air Service during war. Price F. O. B. New York $350.00. Address Box 610, c/o Aerial Age Weekly, 280 Madison Ave., New York City.

FOR SALE—Practically new Standard three place, Hispano-motored, flown 30 hours. Best of condition. First $2500 or will consider automobile in part payment. Jack Morris, Conneaut Lake Park, Penna.

FOR SALE—New Liberty motor parts, reasonable price, immediate shipment. Also brand new Curtiss OX5 cylinders. Never uncrated. Address Grant Motor Co., 912 E. Grand Blvd., Detroit, Mich.

RELIABLE PILOT wishes flying position anywhere. State proposition, first letter or wire. Three years' experience. References. Aviator Brown, 310 East 10th St., Kansas City, Mo.

K-6 ORIOLE, OX5 STANDARD AND JN4D, all in first class condition, for sale at sacrifice. 613 North Marsalis Ave., Dallas, Tex.

FOR SALE—J-1 Standard with OX-5 motor, ready to fly. Whole plane just newly covered. Motor like new. Bargain as it is forced sale for storage rent. $1750.00. Lowell Aircraft Co., Oberlin, Ohio.

CURTISS ORIOLE—With K-6 Motor, Cheap, 2 wings slightly damaged; 34 hours in the air; will exchange for other goods, of equal value. Address Boyertown Auto Co., Boyertown, Penna.

CANUCK OWNERS write for special price list. Most complete stock and promptest service in the east. All parts new and bear C. A. L. inspection marks. Lower wing panel $130, set 6 undercarriage struts $15. Other parts at proportionate figures. American Aircraft, Inc., Station F, Box 104, Baltimore, Md.

THIS IS YOUR CHANCE to become an air-plane expert. Men wanted. Write Leslie Coombs, Chief Engineer, Central Airplane Works, 843 Windsor Ave., Chicago, Ill.

FOR SALE—New OX5 motor, Standard fuse-lage, used 80 hours, with used OX5 motor. both fuselage and motor in good condition. Set of wing panels damaged by windstorm. Can be repaired. Set of tools. All for $1,200 F. O. B. field Fargo, N. D. Write Ed. Axberg, Vallamont Apts., Spokane, Wash.

EX-ARMY PILOT wants job as commercial flier. Will start on very small salary. Will go anywhere. V. M. Jones, 7612 1st Ave., Birmingham, Ala.

SPECIAL VALUES. New Curtiss Canuck, sacrifice for cash. New fabric throughout. Just completed. With new OX5 motor. Ready for test flight September 1st. Performance guaranteed. For quick action, $1,595.00. Rebuilt Canuck, overhauled motor. Ready for test flight. Will trade for good car or sell for $1,250.00 cash. One complete set new Canuck wings, with ailerons. Just covered with best grade fabric, including fittings. Ready for use, $400.00. A quantity of uncovered Canuck and JN4D wings, ailerons, elevators, stabilizers, etc., at correspondingly low prices—for September only. Haug's Independent Airplane Co., 1506 F. & M. Building, Ft. Worth, Texas.

FOR SALE—CURTISS CANUCK, in A-1 Shape. Must be O. K. in every respect; the best ship for stunting and flying in this part of the state. Address Boyertown Auto Co., Boyertown, Penna.

FOR SALE—One Curtiss J.N. with OX5 motor, completely knocked down and in need of new fabric and minor repairs. This is not a crash. Price $500. The Lawrence Sperry Aircraft Co., Inc., Farmingdale, L. I., N. Y., Phone Farmingdale 133.

FOR SALE—Model A 150 Horsepower His-pano Suiza motor, twenty-one hours—tools, complete set spares, including blocks, pistons, etc. Address Box 613, c/o Aerial Age Weekly, 280 Madison Ave., New York City.

FOR SALE—Brand new 3 place Avro. 110 LeRhone motor, $3250. Two thousand cash. Balance terms. Oriole with K6 motor, $3000. JN4 with OX5 motor $1250. Last two completely overhauled and perfect. Muskogee Airplane Co., Muskogee, Okla.

FOR SALE—"F" Boat. Beautifully finished, natural wood hull, aluminum wings. Never been used. $2500. **Also used "F" boat, very good condition $1200. Address P. E. Easter,** 318 Woodlawn Road, Baltimore, Md.

NEW LAWRENCE MOTOR, double cylinder, air-cooled, 28-40 H.P., weight 130 lbs. With ignition system, Zenith carburetor and new ash metal tipped propeller complete $175. Send certified check and avoid disappointment. Heber H. Hunt, Aeronautical Engineer, P. O. Box 1643, Washington, D. C.

FOR SALE—New OX5 motors, $475. Re-built OX5 motors, practically good as new, $300. The Lowell Aircraft Co., Oberlin, Ohio.

FOR SALE—J.N.4-D American Curtiss with OXX 100 H. P. motor. Price $2000.00. Wire F. K. Smith, 14 Hodges Ave., Taunton, Mass.

Smith Life Pack In Action

Actual photograph of Lieut. Hamilton being pulled off plane at Rantoul, Illinois, in recent tests with parachute just opening, showing the perfect operation of life pack

The Floyd Smith Life Pack

Used by the U. S. Army and Air Mail Service

The Parachute That Has

NEVER FAILED

LIEUT. HAMILTON AND SERGT. SCHROEDER used this life pack in their record-breaking jump of 23,700 feet at Rantoul, Illinois.

PILOT C. C. (MIKE) EVERSOLE used this life pack in escaping from his wrecked mail plane at Mendota, Minnesota.

MAJOR R. W. SCHROEDER, A. S. A., chief test pilot U. S. Air Service, wore this parachute in his World Altitude Record flight at McCook's Field.

You Cannot Afford To Be Without One

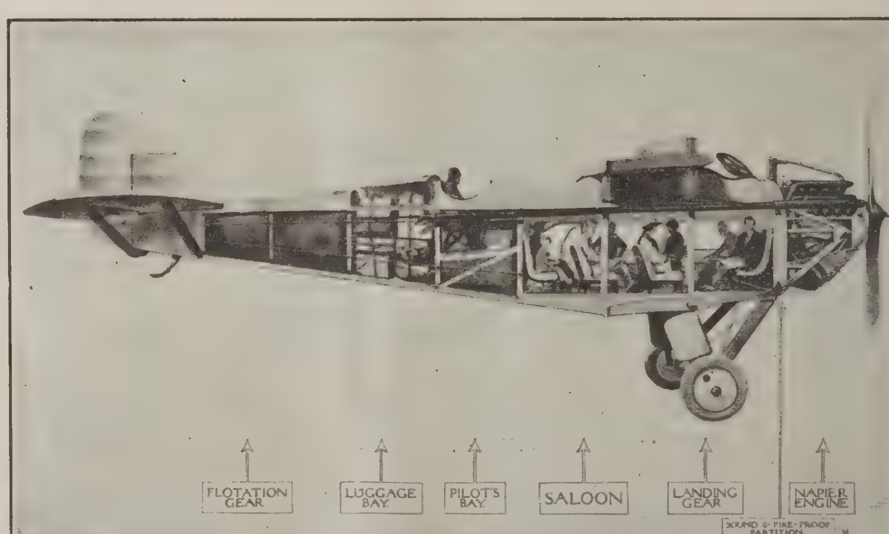
Information and Price Furnished on Application

FLOYD SMITH AERIAL EQUIPMENT CO.

367 W. ADAMS STREET, CHICAGO, ILL.

Any infringement will be prosecuted.

THE DH18



The machine which can transport 8 passengers at a gross cost of **8 cents** each per mile.

IMPORTANT:—By GROSS COST is meant fuel, pilot, insurance, maintenance and depreciation of machine and engine, all overhead charges, and every expense involved in running an air line.

AMERADA ENGINEERING CORP.

505 FIFTH AVENUE
NEW YORK CITY


QUALITY SNAP RINGS
More Than a Million a Month
BUDA The ENGINE
is also equipped with Quality Snap Rings . .
THE Piston RING COMPANY
MUSKEGON, MICH.

THE CAREY PRINTING CO. INC.
NEW YORK